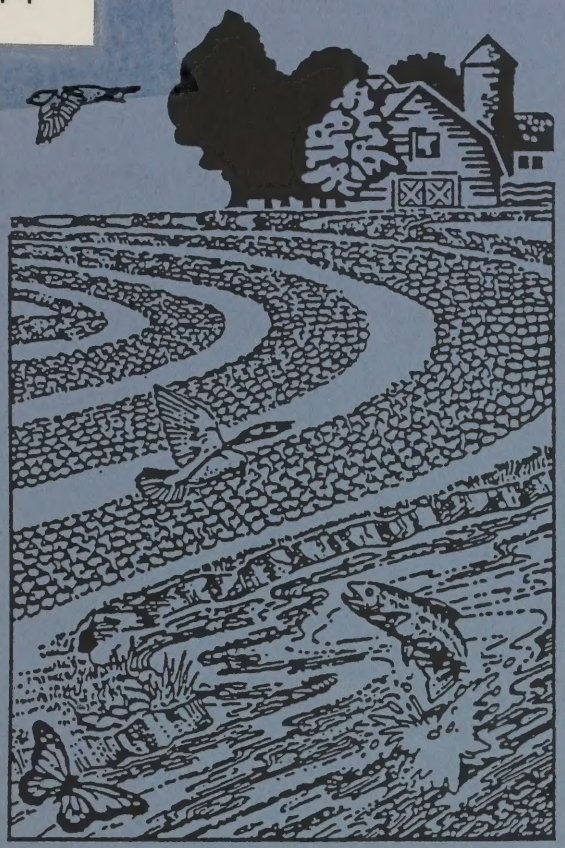

S·A·R·E/A·C·E

Northeast Region 1993 SARE\ACE Report to Congress

Sustainable Agriculture Research and Education
and
Agriculture in Concert with the Environment

June 29, 1993

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The Northeast Region includes

Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia.

SARE/ACE 1993 *Northeast* Report to Congress

Executive Summary

Selected Highlights of Northeast Region Projects

Overview SARE Projects are helping farmers reduce chemical

Soil Test Benefits Farmers and the Environment

By adapting a new soil test nitrogen, farmers can reduce nitrogen fertilizer rates by an average of 50 pounds per acre while still maintaining crop yields. If all growers in the Mid-Atlantic area used the test and got these results, they would save **$41 million** per year and reduce environmental risk by applying **137 million** pounds less nitrogen fertilizer.

(ACE Project number ANE91-4)

Farmers Helping Farmers

More than 60 farmers and agricultural professionals from eight Northeast states are collaborating on strategies to overcome the barriers to sustainable production and marketing systems. As a result, participating growers are trying new techniques, and will share what they learned with other producers next fall.

(SARE Project number LNE91-28)

Crop Rotations Help Control Tree Fruit Pests

A SARE-supported project at The Pennsylvania State University is the first to identify effective rotation crops for controlling dagger nematodes and soil-borne diseases that affect the tree fruit industry. It showed that alternative rotations may provide environmentally sound and economical tactics for combating replant problems that are now primarily controlled through soil fumigation. *(SARE Project number LNE90-22)*

More results from these and other projects are summarized in PART II of this report.

Farmer-Initiated Grants Demonstrate Innovations

Thirty-six small grants, ranging in size from $360 to $6,250, were awarded to farmers for implementation of innovative practices on their farms. See the Appendix to PART I, Attachment D for a description of all 36 grants, including the following examples:

"Subterranean Clover as an Organic Mulch for Pumpkin Production," **Robert K. Clark of Woodstown, NJ.** Funding: $1,576. Clark will test the use of subterranean clover as a mulch crop for co-cultivation with pumpkins. Clark's project, aimed a reducing erosion and synthetic fertilizer and herbicide use, will examine the effect of clover on weed pressure, soil nitrogen, erosion and pumpkin yields.

(Project number FNE93-13)

"Utilizing Municipal Leaf Compost in Apple and Peach Production," **Steve Iuliucci of Braddock, NJ.** Funding: $2,403. Iuliucci will test the use of municipal leaf compost in apple and peach production. Iuliucci's goals are to reduce fertilizer and pesticide use, to improve soil health and fertility, to reduce tree disease, and improve the economic viability of the orchard. *(Project number FNE93-17)*

Regional Program Activities

Mission of the Regional SARE/ACE Program

The Administrative Council drafted its first mission statement and strategic plan, which together form a blueprint for the region's efforts in the next several years. These two documents outline a broad vision for sustainable food and fiber production in the Northeast. Their goal is to build and maintain a healthy, stable agricultural base for the region.

Outreach Efforts Multiply

The Administrative Council requires that all projects contain an integrated, well-planned outreach program to get results to farmers, Extension personnel, other farm consultants and other audiences. Project participants are using field days, workshops, conferences, newsletters, handbooks and videos to disseminate information, reaching audiences in the thousands.

The region also played a leadership role in coordinating the first Sustainable Agriculture Network handbook, *Managing Cover Crops Profitably*, which was released in March. This 114 page book, based in part on SARE-supported research, provides practical information on using cover crops to protect the environment and farm more profitably.

In April 1992, a Communications Specialist (Beth Holtzman) was added to the regional program staff to help disseminate information to the farm community and general public on a regional and national basis. Holtzman created the Regional newsletter, *Innovations*, which contains easy-to-read, farmer-oriented articles about sustainable agriculture. The newsletter, along with direct media contacts have doubled the Region's mailing list, with most of the new interest coming from producers.

Selection of SARE and ACE Projects for Funding in FY 1992

The Administrative Council identified the following areas as priorities for funding: natural systems, animal systems, ornamental horticulture and turf, vegetable production and planning grants for marketing projects. The Regional Coordinator received 52 proposals; After review by Technical Committee, the Administrative Council recommended funding for eight SARE proposals (including four continuing projects) and eight ACE proposals. (See PART II of this Regional report for a list of SARE and ACE projects funded.

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PART I. OVERVIEW

Now in its sixth year, the Northeast Region SARE/ACE program, under the direction of the regional Administrative Council, has taken several innovative steps to promote the goals of sustainable agriculture, as set forth in the Food, Agriculture, Conservation and Trade Act of 1990. Several projects have now reached the results stage. Project results are being disseminated to farmers in ways that encourage adaptation to site-specific conditions, and adoption in ways that will protect the environment, the financial security of the farm families, and the quality of life in rural communities.

Part 1 of this report is an of overview of the Northeast Region's program and its major accomplishments. Parts 2 and 3 contain more comprehensive descriptions and results of all the projects funded by the SARE and ACE programs, respectively.

Mission of the Northeast Program

The Administrative Council held a strategic planning retreat August 8-10, 1992 in Grafton, Vt., to define the Regional SARE and ACE program mission for the next several years, and to begin planning special regional initiatives to advance sustainable agriculture in the Northeast. During the retreat, the Council drafted the region's first Mission Statement and an Action Plan. These documents were adopted at the March 1993 meeting of the Administrative Council. The Mission Statement is as follows:

"Our mission is to help develop and maintain diversified, agricultural and forestry systems that enhance the economic, environmental and social health of the Northeast for present and future generations. Our work will support production, processing and marketing systems that sustain rural communities and connect them with the Northeast region urban and suburban areas.

Sustainable agriculture and forestry systems will:

- promote good stewardship of the land by utilizing production techniques and land management practices that prevent erosion, improve soil health and minimize water and air pollution;
- promote nutrient recycling through profitable use of agricultural by-products and wastes;
- rely on -- and encourage -- greater diversity among farms, and on individual farms, as well as more management-intensive practices that are safe and environmentally sound;
- profitably employ more people in agricultural enterprises, both in full- and part-time capacities;
- offer a viable family living -- economically and socially -- from farming; and

- contribute to the quality of life in rural communities and for society as a whole.

Our efforts in this area will be to

- **promote ongoing, well-funded research and education programs that advance and disseminate the practical and scientific information needed by producers, marketers, processors and planners;**

- **foster greater cooperation among farmers, and new and strengthened partnerships between farmers, consumers environmentalists, scientists, educators, government and agribusiness;**

- **encourage the creation of an infrastructure for food processing and distribution that focuses on regional markets, strategically uses national and global markets, and enables producers to receive economic benefits from "value-added" products;**

- **support public policies and programs that are conducive to sustainable agriculture, and which are based on better public understanding of the region's agricultural base, farming and farm products.**

Partnership with the Environmental Protection Agency

The United States Environmental Protection Agency (EPA) believes that prevention is the first priority within an environmental management hierarchy that includes prevention, recycling, treatment and disposal. In agriculture, EPA and USDA prevention efforts concentrate on issues such as:

- Reduction of the misuse of agricultural chemicals including pesticides and fertilizers and animal waste,

- Adoption of reduced risk pesticides and/or biological controls, and

- Protection of ecologically sensitive areas.

These interests are compatible with USDA goals including those of the SARE program, the Soil Conservation Service, Extension Service and others. EPA is pleased to work in partnership with USDA on ACE and other activities to further the mutual goals of sustainable agroecosystems. EPA believes that the $3 million dollars contributed to the ACE program to date has been a solid investment of funds, and demonstrates the commitment of the EPA - USDA partnership to prevent pollution from agricultural sources.

Highlights of SARE and ACE Project Results

Results of eleven Northeast region SARE and ACE projects are described briefly. Greater detail about these and many other projects is provided in PARTS II and III of this report, where all the Northeast SARE (formerly LISA) and ACE projects are described. These descriptions include information from the annual progress reports received in 1992.

Soil Test Benefits Farmers and the Environment

By adapting a new soil nitrogen test to New Jersey conditions, a team from Rutgers University Cooperative Extension is helping dairy farmers cut the amount of nitrogen fertilizer they use to grow field corn. Results thus far show that farmers can reduce nitrogen fertilizer rates by an average of 50 pounds per acre while still maintaining crop yields. That reduction translates to benefits for both farmers and the environment. The four New Jersey farmers participating in this project saved about $53,000 in fertilizer costs per year on their 3,450 acres of corn. They reduced the risk of groundwater pollution by applying an estimated 177,000 pounds less nitrogen fertilizer than they would have applied without the test. If this test is used on all the corn grown in New Jersey and two adjacent states (New York and Pennsylvania), and if all growers got these results, they would save **$41 million** per year and reduce environmental risk by applying **137 million** pounds less nitrogen fertilizer.

(ACE project number ANE91-4, "Extension of the Pre-Sidedress Soil Nitrate Test for New Jersey Field and Sweet Corn.")[1]

Maine Project Gives New Meaning to "Meat 'n' Potatoes"

Maine's beef industry doubled since 1988 and the state's potato farmers have new, more profitable markets for their by-products and rotation crops thanks in part to a SARE-supported project that funded low-cost ways to integrate potato and beef production systems. Through an aggressive outreach program, participants encouraged cattle feeder operations and helped farmers implement low-cost production systems. Participants also worked to establish an effective cattle feeder marketing program that helped raise the farmgate price of Maine beef. At the same time, project participants worked with potato producers to switch from oat rotations to barley, which is a more desirable grain for cattle production.

The result: A more diverse and sustainable agricultural system. Maine's strengthened cattle industry has already and will continue to place a demand for local rotation crops and local potato

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[1] In assigning identification numbers to projects, the leading letter "A" denotes an ACE project, "L" means it is a SARE (formerly LISA) project; NE refers to the Northeast Region; the year the project was first funded is given before the hyphen; following the hyphen is a sequence number for the specific project.

by-products. "The bottom line was we wanted to put cattle into the system to ... encourage rotation by making rotation crops more profitable," says Project Coordinator R. W. Hough. "Rotations break up disease cycles, help reduce the need for pesticides and increase the quality of the potato crop."

(SARE project LNE90-23, "The Integration of Crop (Potato) and Livestock Production Systems.)

Cover Crops Protect Groundwater -- and Profits

If Maryland farmers used winter cover crops into their corn production systems the way University of Maryland Professor Morris Decker suggests, they could farm more economically with less chance of erosion and groundwater pollution. Decker was project coordinator of two projects that tested the use of winter cover crops on several commercial farms. The results showed that cereal rye/legume mixtures reduced erosion and leaching while providing much of the nitrogen needed for maximum corn production. Researchers found that the composition of a fall-seeded legume/grass mixture will adjust to residual soil levels. When residual soil nitrogen is high, the grasses will dominate. When the residual nitrogen is low, the nitrogen-fixing legume will dominate. "This provides the producer with an excellent nitrogen management tool," Decker wrote. "If findings of this study are widely adapted, it would be possible for producers to reduce fertilizer nitrogen costs with little or no reduction in grain production levels," he said.

(SARE project LNE89-13, Winter Cover Crops for Corn Production in the Northeast; and ACE project ANE91-3, "Use of the Pasture Disk Meter to Promote Wider Use of Conservation Winter Covers by Providing a Rapid Method of Accurately Measuring Winter Legume Nitrogen.")

Green Lawns Without Guilt

Every year, Americans spend millions of dollars on synthetic chemical pesticides and fertilizers in the quest of lush, green lawns. Now, researchers and commercial turf growers are producing low-maintenance sods that can save homeowners cash and reduce their exposure to lawn chemicals. Grass mixtures containing high amounts of tall fescue can reduce the need for irrigation, pesticides and fertilizer, researchers say. Additionally, the mixtures under evaluation seemed to offer at least as much resistance to wear-and-tear as other grasses used for lawns and recreation fields in the Northeast.

A key element in the sustainable grass mixtures the researchers have studied are endophytes -- insect-suppressing fungi that live within the grass plants. The endophytes help plants resist insects in two ways. First, the fungi produce substances that deter insects, prohibit them from feeding or even kill them outright. Secondly, the plant responds to the endophyte as if it were fighting an infection, producing other chemicals which also ward off insects.

(SARE project LNE90-24, "Sustainable Sod Production for the Northeast.")

Low Input Strategies For Cranberries

Cranberry farmers in Massachusetts and New Jersey apply some 530 tons of pesticides and 1,900 tons of fertilizers every year. That comes out to more than 320 pounds of agricultural chemicals per acre. A new ACE project is helping cut that figure in half by giving farmers effective new methods for controlling pests and building fertile soil. "Over the three years of our demonstration program, synthetic insecticide applications were reduced 60 percent and fungicide applications were reduced by 28 percent in comparison to previous years," the team said in its latest progress report. Researchers have found that a practice called late water, in which bogs are reflooded late in the spring once every three years, can be used to significantly reduce pesticide use. Research has shown that when done properly, the practice suppresses rot inoculum, cranberry fruitworm, Southern red mites and perennial weeds. Late water also seems to renew the vine stands and reduce fertilizer requirement, researchers say.

(ACE project ANE91-2, "Implementing and Extending Low-Input Cranberry Production".)

Crop Rotations Help Control Dagger Nematodes

A SARE-supported project at The Pennsylvania State University is the first to identify effective rotation crops for controlling dagger nematodes and soil-borne diseases that affect the tree fruit industry. It showed that alternative rotations may provide environmentally sound and economical tactics for combating replant problems that are now primarily controlled through soil fumigation.

Dagger nematodes are a common, soil-borne pest. They carry a virus that causes lethal diseases in peach, nectarine and certain apple varieties. The research showed that two rotation crops, marigold and canola, effectively suppressed dagger nematodes. Canola, a brassica species, was easier to establish and more successfully competed with weeds. No rotation was as effective at controlling dagger nematodes as soil fumigation, although brassicas and marigolds were as effective after two years as post-plant nematicides in most experiments, researchers found. Several other rotation crops, such as wheat, oats and fescue gave inconsistent results. However, sunflower, sudan grass and alfalfa proved to be good hosts for dagger nematodes, thereby increasing the population of these pests.

Additional research is needed to evaluate differences in nematode control between various cultivars, to continue the search for nematode-suppressive crops, and to develop rotation programs that suppress harmful nematodes and improve soil structure and fertility. Fruit growers have expressed great interest in this work and researchers anticipate that an effective crop rotation program for dagger nematode control would be readily accepted.

(LNE90-22, "Novel Rotation Crops as Alternatives to Fumigant Nematicide Treatment in Deciduous Tree Fruit Production.")

Sustainable Nurseries

Nursery operators will adopt sustainable techniques, so long as the practices are commercially viable, according to the results of a recent survey conducted through one of the Northeast Region's ACE projects. Results showed that vegetable/fruit crop production nurseries and landscape nurseries in the Northeast have made significant moves toward adopting sustainable practices in the last five years. Fifty-four percent of the responding nurseries had reduced fertilizer input, 69 percent have reduced pesticide use, and 71 percent use some form of solid waste recycling.

The goals of the one-year ACE project were to document nursery production practices in the Northeast and to establish a newsletter to encourage nursery operators to adopt more sustainable practices. The monthly newsletter, Hort Impact, was first published in January of 1992. It has been sent to more than 1,000 growers in the Northeast. Although the project concluded in December, 1992, the University of Connecticut Cooperative Extension will continue to publish Hort Impact on a subscription basis, at least for 1993.

The survey was distributed in the August 1992 issue of the newsletter, with follow-up work done in October. Forty-eight nursery operators participated.

(ACE project ANE91-7, "Use of Composts and Reduced Application for Fertilizer and Herbicides to Conserve Soil and Groundwater Resources in Nurseries.")

Breeding Plants for Alternative Systems

Selection criteria for breeding a corn variety for a conventional production system may be inappropriate in selecting cultivars for an alternative system. That's according to a team of Cornell researchers who tried to identify corn varieties that are well-adapted to specific sustainable agriculture practices. Preliminary findings suggest that some specific traits important to productivity of corn in low-input, sustainable systems include good stand establishment, appropriate leaf angle, dark green color under stress and synchronization of pollen shed and silk emergence under stress. These traits, however, have received little study and have not generally been part of plant breeders' selection criteria, said Project Coordinator Margaret Smith. Plant breeding research keyed to sustainable farming systems is needed to "level the playing field."

(ACE project ANE91-1, "Improving Crop Adaptation to Alternative Systems.")

Sustainable Agriculture -- The Movie

Six videos were produced with help from a Northeast Region SARE project and released in 1992. These videos portray progress made by farmers in the Northeast toward sustainable agriculture. Designed as an introduction to sustainable agriculture, the videos document the methods farmers have developed to reduce or eliminate the use of purchased inputs on their farms. A key goal

of the project, spearheaded by the Rodale Institute, of Emmaus, PA, was to offer reliable information about making a transition to a lower-input farming system.

The videos address separately the needs of two kinds of farmers: large scale field crop or livestock farmers, and high-value, vegetable and ornamental growers. The series was produced by Rooy Media, of Frederick, MD, with the help of nearly 200 farmers and other experts. It was filmed in 12 states in the Northeast region of the U.S. The six videos are: "Field Crops," "Rotational Grazing," "Vegetables," "IPM for Vegetables & Small Fruits," "IPM For Apples," and "High-Value Marketing." Each runs for approximately 30 minutes. Accompanying the series is a "Resource and Viewing Guide" that provides basic background on the subject matter of each individual video.

(LNE88-11, "Taking Charge: Strategies for Sustainable Agriculture in the Northeast.")

Farmers Help Each Other Find Sustainable Solutions

An eight-state educational project is helping farmers overcome barriers to organic or sustainable production. The Northeast Farmer-to-Farmer Information Exchange Project has brought more than 60 farmers and agricultural professionals together to share strategies and experience in five commodity groups - apples, strawberries, sweet corn, greenhouse bedding plants and livestock. Although the project is in its early stages, participants say the network is already helping farmers. All of the growers left the winter meetings with several new techniques they intend to try on their farms. Growers reported on the 1992 trials at meetings last winter, and are testing additional ideas through the 1993 growing season. In 1994, participants will be surveyed to find out what techniques they plan to continue using.

(LNE91-28, "The Northeast Farmer-to-Farmer Information Exchange.")

Northeast Regional Program Activities

The Proposal Review Process

The overall process of project selection began in October when the Northeast Region Administrative Council articulated the Call for Proposals, indicating the types of project they considered most important to the attainment of the goals of sustainable agriculture in the Northeast Region that year. The 1992 call for proposals identified the following areas as priorities for funding:

- -- natural systems (as defined in SARE national guidelines);
- -- animal systems (including waste management);
- -- ornamental horticulture and turf
- -- vegetable production;

-- planning grants for marketing projects to evaluate the possibility of new crop or animal enterprises.

All projects were also required to have a functionally integrated, creative, and well developed extension/education program. To encourage farmers to evaluate new approaches, enterprise budgets and/or whole farm budgets were also requested from projects that involved demonstrations, farm case studies, or integrated systems studies.

A total of 52 proposals were received, in the following subject matter areas:

apple production
small fruit production
vegetable production
cash crop production
horticultural plants
composting
decision-making in sustainable systems
cover crops
greenhouse pests
integrating poultry, beef and kenaf

The proposals were first reviewed by the 17-member Technical Committee, which met March 15-17, 1992 in Burlington, Vt. The 18-member Administrative Council met in Burlington, Vt., March 17-18, 1992 to decide grant awards to be recommended to the Secretary of Agriculture. (The members of these two groups are listed in Attachment A, in the APPENDIX to PART I.) A total of 16 projects were funded, including four renewals of continuing SARE projects, four new SARE projects, and eight new ACE projects. (A list of SARE and ACE projects funded in 1992 appears in Attachment B. The amounts of funds granted to organizations in various states are given in Attachment C.)

Types of Projects Currently Active

Of 17 currently active or recently completed SARE projects funded since 1988 for which project profile data are available:

- 12 projects include experimental components;
- 7 are for "educating the educators" (such as Extension);
- 10 contain exploratory components;
- 8 include whole-farm analysis;
- 6 feature whole-farm or ranch demonstration sites;
- 9 will provide accounting budget data on costs and returns for rotations and enterprises; 3 of these will provide data compatible with the Planetor System.

- 14 Extension staff are project coordinators; a total of 31 Extension staff are major participants, and another 35 are cooperators in SARE projects.

Farmers Are Meaningfully Involved

One of the most significant accomplishments of the Northeast Region's SARE and ACE programs is the high level of farmer involvement. Farmers play major roles in administering and operating the program, in cooperation with scientists, educators, and agency personnel. For example,

- 4 farmers serve on the Northeast Region's Administrative Council, which sets the regional program's priorities and determines the level of funding to be grantied to approved projects;

- another 4 farmers serve on the Technical Committee, which recommends projects worthy of funding;

- 124 farmers have helped generate ideas for project proposals;

- 293 farmers are "major participants" in funded projects;

- 139 farmers have made presentations at workshops;

- land is provided for studies of sustainable farming practices and systems:

  -- 33 farmers provide land for replicated studies;
  -- 135 provide land for unreplicated studies;
  -- 55 provide land for demonstration plots;

- 48 farmers help manage projects, and 100 help evaluate the projects.

Farmer/Grower Grants Program Initiated

At the August meeting, the Administrative Council set aside $100,000 of 1993 funds for a new grants program designed to encourage producers to develop and adopt more sustainable production methods. The program received excellent media attention and 169 farmers applied for grants. With the recommendations of the Technical Committee, the Administrative Council funded 36 of these proposals (PART IV).

Site Reviews Conducted on Selected Projects

Four projects were reviewed by special review teams in 1992. Additionally, the Administrative Council informally visited two projects (LNE88-01 and LNE88-02) in August 1992. (See Attachment D for a list of projects reviewed in 1992 and their review teams.)

Guide to Profitable Use of Cover Crops Published

Managing Cover Crops Profitably, a 114-page handbook, was published by the Sustainable Agriculture Network (SAN) in 1992. This handbook was the result of a special project initiated in 1991 by the Northeast Region. Regional Coordinator Fred Magdoff played a key role in the publication, working with Mike Brusko of Rodale Institute, who is currently designated as the SAN Publisher. As of February 28, 1993, 750 copies of the book have been distributed.

Outreach to Extension Agents

The Northeast Region's SARE and ACE programs offered low-cost materials about sustainable agriculture to Extension Agents throughout the Northeast Region. This initiative was designed to help Extension staff build and update their information base on sustainable agriculture.

Nation's First Quality of Life Workshop

The Northeast Region's Administrative Council committed resources to a workshop on quality of life issues. This workshop, the first of its kind nationally, was held in Newark, NJ, on January 28-29, 1993. The purpose was to orient the Region's Administrative Council and Technical Committee to the meaning of quality of life and how this concept could be meaningfully incorporated into the SARE and ACE programs.

Communications Specialist Appointed

Beth Holtzman was hired as Communication Specialist for the Northeast Region SARE and ACE programs April 20, 1992. Holtzman has initiated a wide array of activities to inform the public about the information available through the SARE and ACE programs, and to promote sustainable agriculture in the Region. These activities include:

- producing the Innovations newsletter (3 issues to date);
- active participation in the national Sustainable Agriculture Network;
- compiling a library of photographic slides;
- assisting the SARE associate director with various reports; and
- producing press releases, articles and displays.

Administrative Council Adopts Action Plan

The following statement outlines actions recommended by the Northeast SARE/ACE Administrative Council in August 1992 to achieve its goals for sustainable agricultural and forestry systems in the Northeast. The Council's strategy is threefold: allocating resources to its priorities, forming partnerships with other groups, and informing the public and policy-makers about the benefits of and challenges to a more sustainable agriculture.

The order in which the actions are presented does not indicate priority. Rather, we see many of our recommendations as interdependent.

1. Through the competitive grant process, encourage researchers, farmers and agricultural and environmental groups to fill specific research and education needs determined by the administrative council. These priorities include the following initiatives:

    - Interdisciplinary, whole-farm studies that analyze the economics of environmentally sustainable production techniques and systems. Such projects should encourage the use of appropriate decision-support systems for analyzing the financial and environmental performance of adopting sustainable farming systems.

    - Studies of the quality of life issues farmers face, particularly as they shift to more sustainable practices. Staff and the administrative council will obtain guidance from experts in rural sociology when developing the call for such a project and when evaluating proposals.

    - Projects in which farmers learn from each other about sustainable practices, and projects which help provide incentives for producers to adopt innovative sustainable practices.

    - Agro-ecosystem studies of soil, water, air, plants and animals, as well as proposals that address fish and wildlife habitat and farm woodlands management.

    - The collection of baseline data on the status of agriculture in the Northeast. The Administrative Council, staff and others will use that information to identify opportunities for and obstacles to sustainable agriculture.

    - Conferences, bus tours and other events that educate the farm community, consumers and policy-makers about issues, obstacles and successes in moving toward a more sustainable agriculture.

2. Devote staff time to publicizing priorities for research projects so that the Northeast Region SARE and ACE programs solicit proposals that address the administrative priorities. As the administrative council identifies its priorities for future years, staff will publicize them.

- Staff and the administrative council will develop procedures to insure farmers and growers have a meaningful role in shaping the region's priorities for sustainable agriculture research.

- Staff will make sure that groups and individuals with expertise in natural resources and wildlife issues receive calls for proposal.

3. Promote effective organizing around sustainable agriculture issues by sponsoring leadership training for grass roots organizations. This will be done through a special initiative or competitive grants.

4. Form partnerships with other government agencies, as well as regional grass roots, farm and consumer groups that have common interests with SARE and ACE.

    - Devote staff time to working with national program staff and private organizations to identify other government agencies that are working on issues that pertain to sustainable agriculture (such as pollution, water quality, economic viability, rural development, food safety, human nutrition) and find ways to expand the funding base for common goals. (The ACE program is a national example.)

    - Devote staff and administrative council time to coordinating Northeast Region SARE and ACE initiatives with initiatives at the national level.

    - Devote staff time to building alliances and exchanging information with other groups, including: state agriculture departments; environmental, consumer and farm-based organizations; private industry; and other scientific, research and education organizations.

    - Devote staff and administrative council time to forming an advisory sub-committee to the NE SARE/ACE administrative council to insure meaningful contact and exchange with those groups.

    - Through a special Northeast Region initiative, collaborate with state agriculture departments and Congressional delegations in promoting sustainable agriculture.

5. Disseminate information about sustainable agriculture.

    - Through staff efforts, the competitive grant process and special initiatives, work to inform policy-makers at the local, state, regional and national levels about issues surrounding sustainable food and fiber systems and the options for increasing the stability and sustainability of the region's food and fiber systems. Help farmers communicate directly with policy-makers.

- Through publications and news releases produced by staff, work to heighten consumer awareness about the economic hardships facing small farms; food safety issues; how the choices consumers make at the grocery store affect farmers; the ways agricultural practices affect the environment; and the impact of agricultural and trade policy on the nation's food system.

- Through similar means, work to help farmers understand and address consumer concerns about food safety, food costs and the environment.

- Sponsor or co-sponsor conferences, bus tours, workshops and field days as special NE SARE/ACE initiatives to heighten both consumer and farmer awareness of the above issues.

6. Support sustainable agriculture initiatives in other branches of the USDA and in the State Cooperative Extension System.

    - Support Extension System efforts to provide leadership in the transition to sustainable systems through special initiatives and competitive grants. These efforts should focus on providing person-to-person contact with farmers who are exemplary in development or adoption of sustainable farming methods.

    - Devote staff and administrative council time to supporting sustainable agriculture initiatives within other branches of the USDA.

APPENDIX TO PART I.

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Attachment A. Administrative Council and Technical Committee Members, 1992 and 1993

1992 Administrative Council

Name	Affiliation/Position	Representing	State
George Bird	director, SARE Program	CSRS	DC
James Bushnell	national program leader, agronomy	USDA Extension Service	DC
Ray Eid	DuPont	agribusiness	DE
John Habernern	Rodale Institute	non-governmental org.	PA
Robin Haggie	Chesapeake Wildlife Heritage	conservation organization	MD
Arthur B. Holland	Soil Conservation Service	SCS	PA
Dixon Hubbard	manager, Agri. Competitiveness	USDA Extension Service	DC
Donald Kaufman	USDA Soil Microbial Systems	ARS	PA
Bill Kruesi	farmer, farm consultant	family farms	VT
William Lacy	Penn State Ag. Exp. Station	Ag. Exp. Station Directors	PA
Patrick Madden	Associate Director, SARE	CSRS	CA
Fred Magdoff	SARE & ACE Coordinator		VT
John Merrill	dairy farmer	family farms	NH
Robert Miller	R.I. Cooperative Extension	Cooperative Extension	RI
Brian Mrazik	US Geological Survey	U.S. Geological Survey	NH
Anthony Potenza	grain, vegetable farmer	family farms	NY
Karl Valley	Pa. Agriculture Dept.	NE Commissioners of Ag.	PA
Harry W. Wells	ACE Director	EPA Pollution Prevention Office	DC

1993 Administrative Council

Name	Affiliation/Position	Representing	State
George Bird	SARE Program director	CSRS	DC
James Bushnell	national program leader, agronomy	USDA Extension Service	DC
William Doepkens	farmer	family farms	MD
Ray Eid	DuPont	agribusiness	DE
John Habernern	Rodale Institute	non-governmental organizations	PA
Robin Haggie	Chesapeake Wildlife Heritage	conservation organizations	MD
Bill Kruesi	farmer, farm consultant	family farms	VT
William Lacy	Penn State Ag. Exp. Station	Ag. Exp. Station Directors	PA
Patrick Madden	Associate Director, SARE	CSRS	CA
Fred Magdoff	SARE & ACE Coordinator	University of Vermont	VT
Gordon Marten	USDA/ARS	ARS	MD
John Merrill	dairy farmer	family farms	NH
Robert Miller	R.I. Cooperative Extension	Cooperative Extension	RI
Brian Mrazik	US Geological Survey	U.S. Geological Survey	NH

Anthony Potenza	grain, vegetable farmer	family farms	NY
J.M. Safley Jr.	Soil Conservation Service	SCS	DC
Karl Valley	Pennsylvania Agriculture Dept.	NE Ag. Commissions	PA
Harry W. Wells	ACE Director	EPA Pollution Prevention Office	DC

1992 Technical Committee

Name	Position/Affiliation	Area of Expertise	State
Bill Achor	Lancaster Ag. Preserve Bd.	agronomy/farm management	PA
John Ayers	Penn State University	plant pathology	PA
Dean Collamer	Agway Inc.	plant production	NY
William Doepkens	farmer	veg. &agronomic crops, beef,.	MD
Frank Drummond	University of Maine	entomology	ME
George Green	Penn State Fruit Research Lab	tree fruit	PA
Zane Helsel	Rutgers University Extension	agronomy	NJ
Elizabeth Henderson	organic vegetable farmer	vegetables, small fruit	NY
Bruce James	University of Maryland	soil fertility	MD
Bill Kuenstler	SCS	soil Conservation	PA
Robert Lucey	Cornell University	agronomy	NY
John Myer	organic farmer	agronomic crops	NY
Dale Riggs	Cornell Cooperative Extension	vegetable crops	NY
Eero Ruttila	organic vegetable farmer	vegetables	NH
Fred Suffian	EPA	agronomy	EPA
Region III			
Donald Tilmon	University of Delaware	economics, farm management	DE
Jon Turmel	Vermont Agriculture Department	entomology	VT

1993 Technical Committee

Name	Position/Affiliation	Area of Expertise	State
Bill Achor	Lancaster Ag. Preserve Bd.	agronomy/farm management	PA
John Ayers	Penn State University	plant pathology	PA
Steven Broderick	Extension Service	forestry	CT
Dean Collamer	Agway Inc.	plant production	NY
Richard Conklin	dairy farmer	agronomic crops, livestock	NY
Lewis Daniels	Soil Conservation Service	soils	PA
Gene Galletta	USDA ARS	small fruits	MD
Zane Helsel	Rutgers University Extension	agronomy	NJ
Elizabeth Henderson	organic vegetable farmer	vegetables, small fruit	NY
Bruce James	University of Maryland	soil fertility	MD
Robert Lucey	Cornell University	agronomy	NY
John Myer	organic farmer	agronomic crops	NY
Dale Riggs	Cornell Cooperative Extension	vegetable crops	NY
Eero Ruttila	organic vegetable farmer	vegetables	NH
Carolyn Sachs	Penn State University	rural sociology	PA
Kim Stoner	New Haven Ag. Exp. Station	entomology	CT

Fred Suffian	EPA	agronomy	EPA
Region III			
Donald Tilmon	University of Delaware	economics, farm managment	DE
Jon Turmel	Vermont Agriculture Department	entomology	VT

Areas of Technical Committee Reviewer Expertise, 1992-1993

Agronomy
Dairy farming
Economics
Entomology
Farm management
Forestry
Plant pathology
Plant production
Organic vegetable farming
Organic grain production
Rural sociology
Soil conservation
Soil fertility
Tree fruit
Vegetable crops

Attachment B. Summary List of Northeast Region ACE and SARE Projects Funded in 1992 and 1993.

ACE Projects Funded in 1992:

ANE92-8: Development of Sustainable Cropping Systems.

Project Coordinator: William J. Cox, Soil, Crop and Atmospheric Sciences, 143 Emerson Hall, Cornell University, Ithaca, N.Y. 14853. Phone: 607-255-1758.

Researchers and farmers in upstate New York will demonstrate a market-oriented cash crop system that decreases reliance on chemical pesticides and fertilizers, increases acreage of small grain and oilseed crops, and maintains or improves soil and water quality. All principal investigators have extension appointments.

Participants: Faculty from Cornell University, Cornell field crop agents and 4 farmers.

ACE funding: $60,608. **Matching funds:** $81,939. **Duration:** Two years.

ANE92-9: Sustainable Landscapes.

Project Coordinator: Richard A. Cassagrande, URI, Kingston, RI 02881. Phone: 401-792-2635.

University faculty, extension agents and nurserymen will work together to develop and distribute information on pest-resistant plants and practices. The goal is to provide practical alternatives to heavy use of pesticides and fertilizers in landscaping.

Participants: University of Massachusetts Cooperative Extension, University of Rhode Island, and one nurseryman.

ACE funding: $75,000. **Matching funds:**$97,429. **Duration:** Two years.

ANE92-10: Farmer to Farmer Compost Exchange Project.

Project Coordinator: Denise Conkling, district manager Hartford County Soil and Water Conservation District, 627 River Street, Windsor, CT 06095. Phone: 204-688-7725.

This project will help answer farmers' questions about the opportunities and challenges of composting municipal leaf waste. It will help farmers determine the nutrient value of and best use for the compost, assess the economics of contracting with a municipality, and evaluate options for excess material.

Participants: Hartford County Soil and Water Conservation District, Connecticut Experiment Station, USDA Soil Conservation and Stabilization Service and farmer Jack Collins.

ACE funding: $34,000. **Matching funds:** $19,720. **Duration:** Two and one-third years.

ANE92-11: Alternative Rotation System for Vegetable Production and Soil Conservation.

Project Coordinator: Allen G. Matthews, farmer, Scenery Hill, PA, 15360. Phone: 412-757-6864.

Written and developed by farmers, this two-year project will test alternative production techniques to conserve soil and reduce use of chemical herbicides and pesticides in the southwestern region of Pennsylvania. Participants will evaluate the economic benefits of sustainable practices, develop a database of production and marketing information, and test whether an alternative soil conservation plan can reduce acceptable crop rotations from seven to four years.

Participants: Penn State Cooperative Extension, Soil Conservation Service, FARM Cooperative, Agricultural Stabilization and Conservation Service, H.G. Matthews Family Farm, Washington County Conservation District, Penns Corner Resource Conservation and Development Trust.

ACE funding: $74,131. **Matching funds:** $20,700. **Duration**: Two years.

ANE92-12: Ecosystem Based Orchard Management for Processing Apples.

Project Coordinator: Tara A. Baugher, West Virginia University Experiment Station, Kearneysville, WV 25430. Phone: 304-876-6353.

A 14-acre apple orchard at the WVU Experiment Station will be established to test sustainable orchard practices against conventional systems. The focus: soil management, nematode control, tree establishment and economic analysis.

Participants: West Virginia University, USDA Appalachian Fruit Research Station, WVU Extension, Jefferson County ASCS, West Virginia Horticultural Society, apple processors, West Virginia Department of Agriculture, Penn State University, Virginia Polytech Institute and State University, University of Maryland.

ACE funding: $16,200. **Matching funds:** $15,298. **Duration:** One year.

ANE92-13: Development, Demonstration and Implementation of a Low-Input Sustainable Potato Integrated Crop Management Program.

Project Coordinator: Z. Smilowitz, Department of Entomology, 501 Ag. Sciences & Industry Building, The Pennsylvania State University, University Park, PA 16802. Phone: 814-865-1895.

This four-year project will demonstrate a prototype for sustainable potato production on a commercial farm, evaluating low-input practices against traditional methods. It will include an integrated crop management system to reduce potato pests.

Participants: Penn State University; the Lehigh and Northampton County extension services; Biosys, a biological pest control company; 10 potato farmers.

ACE funding: $25,000. **Matching funds:** $25,734. **Duration:** one year.

ANE92-14: Integrated Kenaf, Broiler Manure and Beef Production System.

Project Coordinator: Thomas H. Williams, University of Delaware, Townsend Hall, Newark, DE, 19717-1303. Phone: 302-831-2468.

This project will promote the use of a waste, broiler chicken manure, as an inexpensive source of feed and pasture fertilizer for beef production in the Delmarva Peninsula. Kenaf, a fibrous annual hibiscus, will be grown and used as chicken litter. Goals include groundwater protection from nitrate pollution and increased farm profitability.

Participants: University of Delaware, Delaware State College, Shawnee Wood Farms, Inc.

ACE funding: $81,500. **Matching funds:** $69,259. **Duration:** Two years.

ANE92-15: Fungal Pathogens for Biological Control of Sweetpotato Whitefly in Greenhouses.

Project Coordinators: Bruce L. Parker and Michael Brownbridge, University of Vermont Entomology Research Laboratory, 655B Spear Street, South Burlington, VT 05403. Phone: 802-658-4453.

Researchers will take aim at a major new greenhouse pest, sweet potato whiteflies, in this investigation into the use of certain fungi as a natural enemy to control insect populations.

Participants: Cornell University IPM Support Group and Department of Entomology; USDA ARS; Biosystems, Denmark; University of Vermont Extension Service; commercial greenhouses.

ACE funding: $68,561. **Matching funds:** $75,314. **Duration:** Two years.

ACE92-16: Development of a Low Input Apple Production System for the Northeast.*

Project Coordinator: L.P. Berkett, University of Vermont Department of Plant and Soil Science, Hills Building, Burlington, Vermont, 05405-0106. Phone: 802-656-0481

Using disease-resistant cultivars and integrated pest management techniques, researchers will continue developing low-input, sustainable apple production systems in five Northeast states.

Participants: University of Massachusetts, Rutgers Fruit Research and Development Center, New York Agricultural Experiment Station, Cornell University, Rodale Research Center, the University of Vermont, apple growers in the participating states.

ACE Funding: $160,000. **Matching Funds:** $70,961.
Duration: One year. (Note: This project began in 1988 and is also receiving SARE funds. See LNE88-01 for more funding information.)

SARE Projects Funded in 1992:

LNE88-01:* Development of a Low Input Apple Production System for the Northeast

Project Coordinator: L.P. Berkett, University of Vermont Department of Plant and Soil Science, Hills Building, Burlington, Vermont, 05405-0106. Phone: 802-656-0481

Using disease-resistant cultivars and integrated pest management techniques, researchers will continue developing low-input, sustainable apple production systems in five Northeast states.

Participants: University of Massachusetts, Rutgers Fruit Research and Development Center, New York Agricultural Experiment Station, Cornell University, Rodale Research Center, the University of Vermont, apple growers in the participating states.

SARE funding: $85,700.
Duration: This project began in 1988. The 1992 grants provided funding for one additional year. (Please note: this project is also receiving ACE funding. See ACE92-16).

LNE88-02:* Improving Farm Profitability By Efficiently Using the Pasture Resource

Project Coordinator: William Murphy, Department of Plant and Soil Science, University of Vermont, Burlington, VT 05405. Phone: 802-656-0485.

Researchers will assist farmers in using controlled grazing to improve the productivity of their land, reduce labor costs and potentially decrease erosion and pollution. Areas to be studied include: forage intake, ration balancing, light relationships among pasture plants and the effects of mechanical treatments of the pasture.

Participants: University of Vermont and Cooperative Extension Service, West Virginia University and Extension Service, State University of New York Syracuse, dairy farmers.

SARE funding: $150,570. **Matching funds:** $91,344.
Duration: This project has been in continuous operation since it was first funded by the LISA program in 1988. The 1992 grants provided funding for one additional year.

* Indicates refunding of an ongoing project.

LNE89-16:* Evaluation of Alternative Strategies for Small Fruit Production

Project Coordinator: Barbara L. Goulart, The Pennsylvania State University, University Park, PA 16802. Phone: 814-863-2303.

Researchers from five Northeastern states will continue efforts to devise and test production techniques for strawberries and brambles that reduce chemical inputs, improve production and maintain or increase marketable yields.

Participants include: The Pennsylvania State University; University of Massachusetts; Cornell University; University of Maine; USDA ARS; extension specialists in New York, Maine, and Massachusetts; fruit producers.

SARE funding: $216,716. **Matching funds:** $190,988.
Duration: This project began in 1989. The 1992 grants provided funding for one additional year.

LNE90-20:* Whole Farm Impact of Converting Conventionally Managed Eastern Vineyards to Organic Management Practices.

Project Coordinator: Chris M. Becker and David M. Gadoury, Department of Plant Pathology, Cornell University, New York State Agricultural Experiment Station, Geneva, NY 14456. Phone 315-787-2367.

This project continues research into the benefits and challenges of converting conventional eastern grape operations to organic management. The project will compare pest populations and problems, vine vigor, yield, fruit composition, juice and wine quality, and production costs in conventionally and organically managed orchards.

Roger Pearson, who died in March of 1993, coordinated this project from 1990 until his death. Pearson was a faculty member of the New York State Agricultural Experiment Station.

Participants: Cornell University N.Y. Agricultural Experiment Station, Vintner's International Inc. vineyard, Cornell University Cooperative Extension Service, Natural Organic Farmer's Association of New York, Four Chimney's Farm Winery.

SARE funding: $123,305. **Matching funds:** $112,623.

* Indicates refunding of an ongoing project.

Duration: This project began in 1990. The 1992 grants provided funding for one additional year.

LNE92-30: Decision Making in Sustainable Agricultural Systems (planning grant)

Project Coordinator: Michelle J. Hutt, University of Southern Maine, 538 Science Building, 96 Falmouth Street, Portland, Maine 04130. Phone: 207-780-4411.

This planning grant will support development of project methodology for possible future case studies on decision-making using a "whole farm" approach.

Participants: University of Southern Maine, Guy K. Hutt, director, Wolfe's Neck Farm.

SARE funding: $5,000. **Matching funding:** $8,480. **Duration:** One year.

LNE92-31: Demonstrating the Economic and Environmental Advantages of Legume Cover Crops to New England Vegetable Growers.

Project Coordinator: Stephen Herbert, Department of Plant and Soil Sciences, University of Massachusetts, Amherst, MA 01003. Phone: 413-545-2250.

Continuing work initiated under two previous LISA (Low Input Sustainable Agriculture) grants, this project is designed to address New England vegetable growers' concerns about using legumes as a cover crop. Through 17 on-farm demonstrations and eight field studies, researchers will evaluate farmer concerns about weediness, establishment time and winter killing and find out whether legume cover-crops will reduce nitrogen, herbicide and fossil fuel inputs.

Participants: University of Maine (Orono), Maine Department of Agriculture, University of Vermont Cooperative Extension, University of Massachusetts Extension, 17 growers in Maine, Massachusetts, New Hampshire and Vermont.

SARE funding: $100,000. **Matching funding:** $143,018.
Duration: Two years and five months.

LNE92-32: A Living Laboratory Classroom for the Integration of Research and Education Efforts on Alternative Vegetable Production Systems.

Project Coordinator: Kenneth L. Steffen, 114 Tyson Building, The Pennsylvania State University, University Park, PA 16802. Phone: 814-865-7118.

Penn State faculty, extension agents and farmers will evaluate ecological, agricultural and economic performance of five vegetable production systems, ranging from a "certified organic'' operation to conventional agrichemical and tillage.

Participants: The Pennsylvania State University departments of Horticulture, Entomology, Plant Pathology, Agricultural Economics and Rural Sociology, and the Penn State Cooperative Extension, four farmers.

SARE funding: $100,000. **Matching funding:** $74,336. **Duration:** Two years.

LNE92-33: Fungal Pathogens for Biological Control of Western Flower Thrips and Green Peach Aphid in Greenhouses.

Project Coordinators: Bruce L. Parker & Michael Brownbridge, University of Vermont Entomology Research Laboratory, 655B Spear Street, South Burlington, VT 05403. Phone: 802-658-4453.

Researchers will study the effectiveness of certain fungi as natural enmemies in inhibiting two insect pests that represent a significant economic threat to the greenhouse industry.

Participants: Cornell University IPM Support Group and Department of Entomology; USDA ARS; Biosystems, Denmark; University of Vermont Extension Service; commercial greenhouses.

SARE funding: $79,709. **Matching funding:** $44,851. **Duration:** Two years.

ACE Projects Funded in 1993:

ANE92-12:* Ecosystem-Based Orchard Management for Processing Apples.

Project Coordinator: Tara A. Baugher, West Virginia University, Experiment Station, Kearneysville, WV 25430. Phone: 304-876-6353.

* Indicates refunding of an ongoing project.

Researchers will continue testing sustainable orchard practices against conventional systems on a 14 acre orchard at the West Virginia Experiment Station. The focus will be on soil management, nematode control, tree establishment and economic analysis.

Participants: West Virginia University, USDA Appalachian Fruit Research Station, WVU Extension, Jefferson County ASCS, West Virginia Department of Agriculture, Penn State University, Virginia Polytech Institute and State University, University of Maryland, West Virginia Horticulture Society, commercial apple processors.

ACE Grant Amount: $50,670 (funding for three years). **Non-federal matching funds:** $47,894. **Other federal funds:** $27,636.

ANE93-17: Improving Nutrient Management on a 100-Cow Free Stall Dairy Farm

Project Coordinator: Everett D. Thomas, W.H. Miner Agricultural Research Institute, P.O. Box 90, Chazy, NY 12921. Phone: 518-846-8020.

Participants will investigate potential alternatives for reducing the amount of nutrients that accumulate on dairy farms, looking at both plant and animal systems. It includes dairy nutrition research to explore techniques to increase digestibility and utilization of forage and grain. and better balance supply and demand of Nitrogen, Phosphorus, and Potasium.

Participants: Miner Institute, University of Pennsylvania, Cargill, Inc.

ACE Grant Amount: $97,000 for three years. **Matching non-federal:** $24,507.

LNE93-36, ANE93-18: Ecological Management of Potato Cropping Systems

Project Coordinator: Gregory A. Porter, Department of Plant, Soil and Environmental Sciences, University of Maine, Orono, Maine 04469-5722. Phone: 207-581-2943.
This project is part of a larger, interdisciplinary "Potato Agroecosystem" project. SARE/ACE funds will be used to investigate the effects of green manure, compost and manure soil physical properties, and to determine the impact of four biocontrol agents on Colorado potato beetles.
Participants: University of Maine, USDA-ARS New England Plant, Soil & Water Laboratory.

SARE/ACE Grant Amount: $150,000 for two years. **Non-federal matching funds:** $138,838. **Other federal funds:** $377,971.

SARE Projects Funded in 1993:

LNE93-34: An Integrated Extension/Research Program for Replacing Herbicides With Mechanical Cultivation in New York State

Project Coordinator: Jane Mt. Pleasant, 146 Emerson, Cornell University, Ithaca, New York 14853. Phone: 607-255-1755.

This project is designed to help farmers find out how to introduce mechanical cultivation into a variety of cropping systems and fine-tune machinery for their needs. Participants will hold a series of winter cultivation clinics, help establish a farmer-to-farmer information network and sponsor summer field tours of on-farm trials and demonstration plots. The information and techniques presented will be based on research which has recently been completed or is currently underway at Cornell.

SARE/ACE Grant Amount: $103,235 for two years. **Non-federal matching funds:** $70,246.

LNE93-35: Develop Crop Rotational Budgets for Three Cropping Systems in the Northeast

Project Coordinator: Robin G. Brumfield, Dept. of Agricultural Economics and Marketing, Cook College, Rutgers University, P.O. Box 231, New Brunswick, New Jersey 08903-0231. Phone: 908-932-9171.

This project will develop enterprise budgets for a variety of crop and livestock operations under conventional, reduced-input and organic production systems. It is geared to conventional farmers who are considering switching to low-input or organic production systems.

Participants: Rutgers, University, The Pennsylvania State University, Natural Organic Farmers Association of N.J., University of New Hampshire, University of Massachusetts, University of Delaware, University of Maryland, University of Vermont

SARE/ACE Grant Amount: $60,846 for two years. **Non-federal matching funds:** $159,742.

LNE93-36, ANE93-18: Ecological Management of Potato Cropping Systems

Project Coordinator: Gregory A. Porter, Department of Plant, Soil and Environmental Sciences, University of Maine, Orono, ME 04469-5722. Phone: 207-581-2943.

This project is part of a larger, interdisciplinary "Potato Agroecosystem" project. SARE/ACE funds will be used to investigate the effects of green manure, compost and manure soil physical properties, and to determine the impact of four biocontrol agents on Colorado potato beetles.

Participants: University of Maine, USDA-ARS New England Plant, Soil & Water Laboratory.

SARE/ACE Grant Amount: $150,000 for two years. **Non-federal matching funds:** $138,838. **Other federal funds:** $377,971.

LNE93-37: Integrating Stewardship Forestry into Total Farm Management

Project Coordinator: Stephen B. Jones and James C. Finley, The Pennsylvania State University, School of Resources, 110 Ferguson Building, University Park, PA 16802. Phone: 814-863-0401.

Participants will establish six demonstration/research replicates to examine the environmental and economic benefits of proper farm woodlot management. Educational and outreach activities will focus on helping farmers learn how to manage their forests wisely.

Grant Amount: $48,408 for three years. **Non-federal matching funds:** $52,948.

LNE93-38: Biodiversity Education Through the Pennsylvania Forest Stewardship Program

Project Coordinator: James C. Finley and Stephen B. Jones, The Pennsylvania State University, School of Resources, 110 Ferguson Building, University Park, PA 16802. Phone: 814-863-0401.

The goal of this project is to provide professional foresters with a method to rapidly assess the nature and quality of habitat components and to provide private forest landowners, including farmers, with an understanding of biodiversity. Participants will established a biodiversity demonstration site, produce a field manual, hold workshops.

Grant Amount: $23,508 for one year. **Non-federal matching funds:** $16,940.

LNE93-39: Systems Analysis of Organic and Transitional Dairy Production

Project Coordinator: Enid Wonnacott, NOFA-Vermont, 15 Barre Street, Montpelier, VT 05602. Phone: 802-229-4940.

Participants will conduct detailed farm management analyses on four certified and four transitional dairy farms to obtain accurate information on the real costs of sustainable dairy production -- economic, environmental and soil. Because of the diversity of the farms, each will be analyzed as case-studies, providing relevant information for farms with similar characteristics.

Participants: NOFA-VT, University of Vermont and Cooperative Extension

Grant Amount: $165,000 for three years. **Non-federal matching funds:** $73,223. **Other federal funds:** $57,885.

LNE88-01, ACE92-16:* Development of a Sustainable Apple Production System for the Northeast

Project Coordinator: Terry Schettini, Rodale Institute Research Center, 611 Seigfriedale Road, Kutztown, Pennsylvania 19530. Phone: 215-683-6383.

Using disease-resistant cultivars and integrated pest management techniques, researchers will continue developing sustainable apple production systems in five Northeast state.

Participants: Rodale Institute, Rutgers University, University of Massachusetts, University of Vermont, Cornell University and apple growers in the five states.

SARE Grant Amount: $97,800 for one year.
ACE Grant Amount: $164,200 for one year. **Non-federal matching funds:**

LNE88-02:* Improving Farm Profitability by Efficiently Using the Pasture Resource

Project Coordinator: Bill Murphy, Plant and Soil Science Dept., University of Vermont, Burlington, VT 05405-0082. Phone: 802-656-2630.

* Indicates refunding of an ongoing project.

Researchers will assist farmers using controlled grazing to improve the productivity of their land, reduce labor costs and potentially decrease erosion and pollution. Areas to be studied include forage intake, ration balancing, light relationships among pasture plants and the economic effects of well-managed grazing.

Participants: University of Vermont and Cooperative Extension Service, West Virginia University and Cooperative Extension Service, State University of New York Syracuse, dairy farmers in Vermont.

SARE Grant Amount: $121,058 (funding to completion of project).

LNE90-20:* Whole Farm Impact of Converting Conventionally Managed Eastern Vineyards to Organic Management Practices

Project Coordinator: Chris. M. Becker, Cornell University, New York State Agricultural Experiment Station, Geneva, NY 14456. Phone: 315-787-2367.

This project continues research into the benefits and challenges of converting conventional eastern grape production to organic management. During this final funding period, the researchers will compare pest populations and problems, vine vigor, yield, fruit composition, juice and wine quality, and production costs in conventionally and organically managed vineyards.

Participants: Cornell University/N.Y. Agricultural Experiment Station, Vintner's International Inc. (Commercial Vineyard) Natural Organic Farmers Association of New York, Four Chimney's Farm Winery.

SARE Grant Amount: $67,932 (funding to completion of project).
Non-federal matching funds: $112,623.

LNE92-32:* A Living Laboratory/Classroom for the Integration of Research and Education Efforts on Alternative Vegetable Production Systems

Project Coordinator: Kenneth Steffen, 114 Tyson Building, The Pennsylvania State University, University Park, PA 16802. Phone: 814.-865-7118.

* Indicates refunding of an ongoing project.

Participants will evaluate ecological, agricultural and economic performance of five vegetable production systems ranging from a certified organic operation to conventional agrichemical and tillage system.

Participants: The Pennsylvania State University and Penn State Cooperative Extension Service.

SARE Grant Amount: $120,000 for one year. **Non-federal matching funds:** $74,336.

LNE91-27*: An Integrated Response to Pollination-Related Problems Resulting from Parasitic Honey Bee Mites, the Africanized Honey Bee and Honey Bee Pathogens

Project Coordinator: Nicholas W. Calderone, ARS Bee Research Laboratory, Building 476 BARC-EAST, Beltsville, Maryland 20705. Phone: 301:504-8574.

This project is addressing pollination-related problems from four perspectives. It is demonstrating a honey bee breeding project designed to develop mite-tolerant bees and offer alternative mite controls; it is evaluating naturally occuring plant compounds for mite control; it is developing an expert system model for bee keepers; and it is developing an educational video and booklet to help growers evaluate rented colonies.

Participants: ARS, Cornell University.

SARE Grant Amount: $39,250 (funding for two years to completion of project). **Non-federal matching funds:** $24,484. **Other federal funds:** $69,501.

* Indicates refunding of an ongoing project.

Attachment C. Funds Granted to Organizations in Specific States in 1992 by the ACE and SARE Programs.

ACE 1992 FUNDS	ACE	NON-FED MATCH
Connecticut		
Hartford Co. Soil & Conservation Dist.	34,000	19,720
Delaware		
University of Del.	63,135	60,359
Delaware State Col.	18,365	8,900
Total	81,500	69,259
Massachusetts		
University of Mass.	57,362	0
New Jersey		
Rutgers University	43,659	43,560
New York		
Cornell University	112,102	109,340
Pennsylvania		
Penn State University	25,000	25,734
Penn's Corner's Trust	22,140	3,840
F.A.R.M. Coop	51,991	16,860
Total	99,131	46,434
Rhode Island		
University of R.I.	75,000	97,429
Vermont		
University of Vermont	81,046	75,314
West Virginia		
West Virgina Univers.	16,200	15,298
TOTALS	600,000	476,354

SARE 1992 FUNDS	SARE	MATCH
Maine		
University of Maine	61,997	98,914
MOFGA	800	0
Maine Dept. of Agric.	5,300	1,440
University of S. Me.	5,000	8,480
Total	73,097	108,834
Massachusetts		
University of Mass.	118,873	61,352
New York		
Cornell University	166,069	183,613
SUNY Syracuse	4,500	4,544
Total	170,569	188,157
Pennsylvania		
Penn State University	159,862	119,359
Rodale Research Ctr.	52,546	0
Total	212,408	119,359
Vermont		
University of Vermont	238,764	122,192
West Virginia		
West Virgina Univers.	30,969	16,526
USDA/ARS	16,320	49,220
Total	47,289	65,746
TOTALS	861,000	665,640

Attachment D. Site Reviews Conducted for SARE and ACE Projects in the Northeast Region during FY 1992 and thus far in FY 1993

1. LNE88-04, "Whole farm implementation of Alternative Agriculture Practices for Field Crops," conducted at East Aurora, NY, 12/11/91.

2. ANE91-1, "Improving Crop Adaptation to Alternative Systems," conducted at Cornell University, Feb. 11, 1992.

Review Team

Name	**Organization**	**AC/TC/Other**
Ed Jones,		TC
Bill Kruesi	farm consultant	AC
Fred Magdoff	NE SARE/ACE Coord.	AC
Tony Potenza	organic farmer	AC
Eric Veitenheimer		Other
Harry Wells	USEPA-ACE director	AC

3. ANE91-2, "Implementing and Extending Low-Input Cranberry Production," conducted at the Cranberry Experiment Station, East Wareham, Mass.

Review Team

Name	**Organization**	**AC/TC/Other**
Brian Chabot	Cornell	AC
Frank Drummond	University of Maine	TC
George Greene	Penn State	TC
Fred Magdoff	NE SARE/ACE Coord.	AC
Eero Ruttilla	organic farmer	TC

4. LNE89-16, "Evaluation of Alternative Strategies for Small Fruit Production," conducted at The Pennsylvania State University, February 6, 1992.

Review Team

Name	**Organization**	**AC/TC/Other**
Gene Galletta	ARS	Other
John Haberen	Rodale Institute	AC
Elizabeth Henderson	farmer	TC
Patrick Madden	SARE Assoc. Director	AC
Fred Magdoff	NE SARE/ACE Coord.	AC
Bob Miller	R.I. Extension	AC
Tony Potenza	organic farmer	AC

5. LNE88-02, "Improving Farm Profitability by Efficiently Using the Pasture Resource," conducted in South Burlington, Vermont, Dec. 11, 1992.

Review Team

Name	Organization	AC/TC/Other
George Bird	SARE Director	AC
Bob Lucey	Cornell	TC
Fred Magdoff	NE SARE/ACE Coord.	AC
John Merrill	dairy farmer	AC
Charlie Sniffen		Other
Don Tilmon	University of Delaware	TC

6. LNE88-01, "Development of a Sustainable Apple Production System for the Northeast." conducted at Cornell University, Ithaca New York on Jan. 15, 1993.

Review Team

Name	Organization	AC/TC/Other
George Bird	SARE Program Director	AC
Gene Galletta	USDA/ARS	TC
Fred Magdoff	NE SARE Coordinator	AC
Tony Potenza	Organic Farmer	AC
Don Tilmon	University of Delaware	TC
Harry Wells	USEPA-ACE Director	AC

7. LNE90-20, "While Farm Impact of Converting Conventionally Managed Eastern Vineyards to Organic Management," conducted at Cornell University, Ithaca, New York, on 1/14/93.

Review Team

Name	Organization	AC/TC/Other
George Bird	SARE Program Director	AC
Gene Galleta	USDA/ARS	TC
Fred Magdoff	NE SARE Coordinator	AC
Tony Potenza	Organic Farmer	AC
Don Tilmon	University of Delaware	TC

PART II. SARE PROJECTS FUNDED 1988 TO 1993

The following are descriptions of all the Northeast Region LISA and subsequently SARE projects funded from 1988 through 1993, including results from the progress reports received in 1992.

Table of Contents of PART II

LNE88-1: DEVELOPMENT OF A LOW-INPUT APPLE PRODUCTION SYSTEM FOR THE NORTHEAST

(Revised 4/14/93)

Major Participants:

Pennsylvania: T.M. Schettini, Horticulture Section Coordinator, Rodale Research Center, 611 Siegfriedale Road, Kutztown, PA 19530; contact person and project adviser for Rodale portion of the project; Rodale responsibilities include coordination and administration of their Horticulture Dept. and advising for experimental designs and analyses; areas of expertise include plant breeding and plant tolerance to environment stresses; S. Wolfgang, Orchard Project Leader; responsible for establishment and management of test plots, data collection and summary; responsibilities at Rodale include project planning and management of orchard trials; experience in alternative pest management in apple production; D. Matthews-Gehringer, Entomology Project Leader; responsible for planning and conducting insect habitat studies at the Research Center; research experience in surveying plants for insect populations and monitoring the effects of intercropping, physical barriers, mulches, and botanical insecticides on insect populations.

University of Vermont: Lorraine P. Berkett (Project Coordinator), Dept. of Plant and Soil Science, Hills Building, Burlington, VT 05405. State contact person and general organizer for Vermont portion of project; as project coordinator responsible for assembling project proposals, chairing meetings, and coordinating other LISA activities between the five member states; project expert on powdery mildew; expertise in predaceous mites affecting apples; responsible for control and assessment of strategies involving diseases, arthropods, pest management ground cover practices and the integration of these various components; responsible for extension/outreach activities. J.F. Costante, Dept. of Plant and Soil Science, project expert on pomology practices involving research assessments of cultivar/rootstock combinations, biological controls for apple replant disease, cultural harvest, storage, and marketing practices as well as related extension/outreach activities.

University of Massachusetts: D.R. Cooley, Dept. of Plant Pathology, Amherst, MA 01003. Contact person and general organizer for Massachusetts portion of the project; editor and publisher of the newsletter; cooperator on summer disease research and post-harvest disease research; evaluation of disease on disease-resistant cultivars in MA; W.R. Autio, Dept. of Plant & Soil Sciences, project expert on post-harvest maturity and storage; horticulturist cooperating on groundcover effects on tree growth; responsible for fruit quality evaluation in MA; R.J. Prokopy, Dept. of Entomology, project expert on insect management in disease-resistant apples and integrated pest management; responsible for strategies for minimizing chemical use in controlling apple insects; cooperating in mite management studies in MA; W.M. Coli, IPM

Program Coordinator, Dept. of Entomology, studying groundcover and pesticide effects on mites and mite predators for development of biocontrol strategies; contributing and interfacing IPM resources with LISA in MA; C.R. Harper, IPM Agricultural Economist, Dept. of Agricultural and Research Economics, developing budgets and financial decision aids for growers considering planting disease-resistant cultivars.

New Jersey: D.F. Polk, Rutgers Fruit Research and Development Center, IPM Agent-Fruit, Dept. of Agriculture and Resource Management, RD2, Box 38, Cream Ridge, NJ 08514, contact person and general organizer for New Jersey portion of project; project expert on integrated pest management of fruit crops; in NJ, responsible for general pest management strategies, and insect and mite damage assessments; E.F. Durner, Dept. of Horticulture and Forestry, project expert in NJ on horticultural aspects of apple cultivars; in NJ, responsible for horticultural evaluations and for statistical analysis of data; J.C. Goffreda, Dept. of Horticulture and Forestry, tree fruit breeder, and director of the disease-resistant apple breeding program at Rutgers; responsible for evaluation, propagation, and distribution of new selections; W.P. Cowgill, Rutgers Cooperative Extension of Hunterdon County, 4 Gaunt Place, Flemington, NJ 08822, County Agricultural Agent-Hunterton County, Dept. of Agriculture and Resource Management Agents, coordinates the management of NJ research plots; responsible for grower liaison and grower education efforts in northern NJ; J.L. Frecon, Rutgers Cooperative Extension of Gloucester County, County Office Building, N. Delsea Drive, Clayton, NJ 08312, County Agricultural Agent-Gloucester County, Dept. of Agriculture and Resource Management Agents, project expert in NJ on disease-resistant cultivars; responsible for grower liaison and grower education efforts in southern NJ. W.H. Tietjen, Rutgers Cooperative Extension of Warren County, Dumont Administration Building, Rt. 519, Belvidere, NJ 07823, Fruit IPM Program Associate-Warren County, Dept. of Agriculture and Resource Management Agents, responsible for grower education and public relations efforts in Warren County. J.K. Springer, Rutgers Resource and Development Center, RD 5, Box 232, Bridgeton, NJ 08302, Dept. of Plant Pathology, project expert in NJ on apple diseases; responsible for disease control strategies and disease evaluations in NJ.

New York: New York Agricultural Experiment Station, Geneva, NY 14456: D.A. Rosenberger, Dept. of Plant Pathology, contact person and general organizer for New York portion of the project; project expert on summer diseases and postharvest diseases of apples; in NY, responsible for disease control strategies, disease damage assessments, and postharvest studies. R.W. Weires, Dept. of Entomology, project expert on chemical control of insects and mites; in NY, responsible for arthropod control strategies and arthropod damage assessments; R.C. Lamb, Dept. of Horticultural Sciences, plant breeder -- expert on horticultural aspects of disease-resistant apple cultivars; M.J. Fargione, Cornell University, Dept. of Natural Resources, Ithaca, NY 14853; project expert on wildlife management and damage control; in NY, provides expertise and assistance in controlling deer and voles in experimental plantings; M. Castaldi, Regional Extension Specialist, Cornell Cooperative Extension Service;

project expert on micro-economic analysis of disease-resistant apple production systems; L.S. Willett, Dept. of Agricultural Economics; project expert on macroeconomics; W. Smith, Ulster County Cooperative Extension Fruit Agent, Ulster County Cooperative Extension, Highland, NY, 12528; responsible for grower liaison and grower education efforts in NY.

Farmer Participants:

New Jersey: K. Moriuchi, Fruit Grower, Moriuchi Farms Inc., RD2, Borton Landing Rd, Mooretown, NJ 08057; G. Mount, Fruit Grower, Terhune Orchards, 330 Cold Soil Road, Princeton, NJ 08540; E. Wright and M. Nelson, Fruit Growers, Fruitwood Orchards, P.O. Monroeville, NJ 08343, fruit growers who provide the land for research and demonstration plantings; provide the required commercial management for the establishment and maintenance of plantings; provide data on pest management and other needed inputs; and provide commercial perspectives on project objectives, cultivar acceptability, and marketing potential.

New York: S. Clark, Fruit Grower, Sunshine Orchards, Box 183 Clarke's Lane, Milton, NY 12547; A. Hepworth, Fruit Grower, Hepworth Farms, Box 41, Route 9-W, Milton, NY 12547; and L. Ryan, Fruit Grower, Breezy Hill Farm, Center Road, Staatsburg, NY 12580; fruit growers who provide land for research and demonstration plantings on their farms; assist in establishing and maintaining plantings; provide commercial perspectives on project objectives, experimental designs, cultivar acceptability, and marketing strategies.

Overview

Apples are the most extensively grown fruit in the Northeastern US, approximately 162,000 acres. Apple production requires very intensive management to produce high-quality fruit. Economical, effective pest management is a critical component in achieving profitable apple production. If the insects and diseases are not controlled, the apples can't go into fresh market; they have to go into applesauce or juice at a much lower price, and profits plummet. Currently, apple production involves the use of pesticides and fertilizers at an annual cost of about $250 per acre for bearing orchards in the Northeast, though this cost varies greatly from year to year and from one orchard to another. Growers may apply up to twenty fungicide sprays per season in an attempt to prevent apple diseases. As pesticide costs continue to increase and as more pests develop resistance to pesticides, it is costing more and more for pest control that is doing less and less good. Public concern about pesticide contamination of food, ground and surface water, and other environmental damage is growing rapidly. It is absolutely vital that we find alternatives to pesticides.

The objectives of this research project have been to develop low-input, sustainable apple production using disease resistant apple cultivars and IPM techniques. Investigators at

several universities (Universities of Vermont and Massachusetts, Rutgers and Cornell) plus the Rodale Institute formed a team to conduct this LISA project, coordinated by Lorraine Berkett. This team of scientists, educators, and farmers has successfully developed and implemented a long-term, comprehensive, multi-disciplinary, and multi-state research program involving an extensive network of researchers and farmers throughout the Northeastern region.

Apple disease-resistant cultivars (DRCs) offer a biological alternative to fungicides. DRCs have been bred specifically for their resistance to apple scab, a major disease in the Northeast. Ecologically sound pest control strategies also must be developed for the insect, mite, disease and weed problems that will continue to exist after DRCs are planted. For the past two-and-a-half years the cooperators in this project have pursued a holistic approach to the development of a more sustainable production system using DRCs and horticultural and pest management research. The study has been expanded to include nineteen new plantings in the five cooperating states (Vermont, Massachusetts, New Jersey, New York and Pennsylvania) to supplement the eight plantings which started this project. There are over 4,000 trees and at least 38 named and numbered cultivars available for data collection.

Rapid and effective information dissemination has also been a priority of this project as well. To meet this need, the project published two issues of the Northeast LISA Apple Newsletter, with 1,245 subscribers in 39 states and six foreign countries. While the use of DRCs will reduce the need for fungicides, growers still need to control insects, weeds, diseases, and mites. The main work in this project is to develop ecologically sound pest control strategies. Since many of these new strategies will be applicable to standard orchards, this work has broad implications. Consequently a Management Guide for Low-Input Apple Production has been written and published. Project team members have made 53 presentations at grower and professional meetings or workshops.

Recognizing that disease-resistant cultivars in the past have sometimes been highly successful in repelling diseases, but failed miserably in the marketplace, the project team established a consumer taste test at a Vermont supermarket. Consumer preference for the Liberty, one of the disease-resistant cultivars, was overwhelming.

Objectives

(1) Develop low-input, sustainable apple production systems in the northeast using disease-resistant apple cultivars and IPM techniques.

Pesticides are one of the major purchased inputs in northeast apple production. Because of environmental and health concerns, consumers, processors, retailers, government officials, and neighboring landowners are all proposing that apple growers reduce pesticide use. Reducing pesticide use is critically important in the northeast where increasing urbanization has resulted in more people living adjacent to farm operations. Growers themselves want to reduce their use of pesticides; they are very interested in using alternatives for environmental, health and economic reasons and because the loss of registrations of standard

pesticides and pest resistance to pesticides have left frightfully few chemical controls for apple pests.

Fungicides represent a significant proportion of the pesticides applied to apples each year. Growers apply up to twenty fungicide sprays per season; eliminating just one application across the entire region would reduce the amount of fungicide applied by approximately 243 tons annually (based on the recommended rates of Captan). Most fungicides are applied to control apple scab and other diseases that could be avoided by the use of disease-resistant cultivars (DRCs). Incorporating DRCs into apple production systems would significantly reduce the need for fungicides and perhaps other pesticides as well. However, the horticultural strengths and weaknesses of DRCs must be clearly defined before commercial growers will risk planting large acreage to these cultivars. Cultivar selection is a crucial decision for an apple grower because the decision will impact the farm's profitability for at least fifteen to twenty years. Factors that growers consider when deciding what cultivars to plant include winter hardiness; yield potential; fruit storage qualities, color, taste, and size; potential pest management problems; and marketability. We propose to speed the process of getting DRCs into large-scale production through a multi-state and multi-disciplinary cultivar evaluation and through rapid dissemination of research results.

Use of DRCs will reduce the need for fungicides in apple production, but growers will still need to control insects, mites, weeds, and several important diseases including frog-eye leaf spot, fly speck, sooty blotch, bitter rot, white rot, and black rot. Therefore, we also propose to develop ecologically sound pest control strategies for these important biological factors that impact apple production. We may find that reducing fungicides favors certain beneficial predators or parasites which will aid in the biological control of other pests or that it may allow formerly minor disease problems from the bottom up (i.e., from no controls, to minimal or alternative practices necessary for profitability), we hope to reduce grower reliance on chemical controls. Since many of these new pest management strategies also will be applicable to standard orchards, the potential benefits and impact of this research are significant.

The existing project participants are uniquely qualified to pursue the interdisciplinary research we are proposing. Many participants have been involved with IPM studies and have an appreciation for multi-disciplinary research. Most participants also have worked directly with growers in previous research or educational efforts, have knowledge of the real-life complexity of apple production, and are well-positioned to work with commercial growers. The participants have complementary areas of professional expertise and, over the past two-and-a-half years, have formed an effective working group. The north-south geographical spread of the project participants and the large variety of soil types, climatic factors and production orientations represented ensures that research results will have application for growers throughout the northeast.

(2) Provide economic analyses of low-input production systems and forecast impact on the northeast apple industry.

Again, cultivar selection is a crucial decision for an apple grower which will impact the farm's competitiveness and profitability for many years. About $8,000 per acre will be invested before the trees become profitable, and it will take ten or more years to reach that point. Extensive changes in the apple cultivars grown in the northeast and in production practices will induce new economic issues for individual growers and the industry as a whole. Project economists have developed a standardized record-keeping system to use with low-input plantings and have begun to assess the economic state of the apple industry in the northeast. By incorporating both macro- and microeconomics into analyses, we will determine how low-input systems will impact individual farms and the entire industry.

(3) Expedite research and information transfer on low-input apple production systems for the northeast.

Growers and industry personnel are being constantly challenged to make economically and environmentally sound decisions that satisfy all the demands of a dynamic, ever-changing world. The daminozide (Alar) issue and the EBDC fungicide issue just underscore the rapid change that is taking place in the apple industry. Growers must have access to research-generated information that addresses the critical issues facing them and that will enable them to make intelligent decisions.

In the first two-and-a-half years of the project, we have established an effective network of growers, researchers, extension and outreach personnel, consultants, regulators and laypeople concerned with low-input, sustainable apple production. We have developed and implemented an information delivery system that has been highly praised by all segments of the agricultural community. This effort will be continued and expanded to broaden the scope of the network.

Results to Date:

During the past three years, we have planted more than 3,500 DRCs in 50 experiments at commercial and research orchards. We now have three years of data on tree establishment, nutrition, varietal response to different training systems, disease and climatic tolerance, and other important horticultural attributes. Many of these observations have been published or presented to fruit growers in various meetings and other forums. The actual plantings have also been visited by thousands of growers, providing a tangible demonstration of the feasibility of these varieties.

Since apple trees do not produce marketable crops until the third of fourth year, we are only now beginning to generate the yield data which will determine whether these new varieties will be competitive with old standards like McIntosh and Delicious. The data we have gathered since 1989 indicate that several of the DRCs, for example Liberty and Nova Easygro, are very promising. The next three to seven years will provide definitive data for recommendation of the best DRCs and expedite their adoption by the industry.

While it is too early to draw definitive or even tentative conclusions about these new apple varieties, several important trends appear to be emerging from continuing studies. They are:

1. A few of the DRCs, especially Liberty, are likely to be as good or better overall than many conventional apple varieties, aside from their reduced fungicide costs.

2. Fruit quality of DRCs varies considerably by region, as it does for other apple varieties. Taste and appearance of a given DRCs have differed greatly over the range of soils and climates included in our studies.

3. The general horticultural management requirements of the DRCs appear not to differ substantially from conventional cultivars.

4. Consumer acceptance of the DRCS has been positive and enthusiastic.

5. The so-called summer diseases are likely to be a real problem with DRCs, especially in warm humid summers or regions. New management strategies will be required for these hitherto "minor" disease when apple-scab fungicides are discontinued, and we are already working to develop and test such strategies in our studies.

6. Winter hardiness of wood and buds has been good in the DRCs, although a "test" winter with extreme low temperatures has not occurred during these studies.

Project participants gave presentations about various facets of converting to organic wine grape production, including challenges of fungus, insect and weed control in organic production systems.

Project Duration: Given the nature of the research and the crop, this is viewed as a long-term project of 7-10 years. We are currently requesting funds to continue this project from July 1, 1990 through June 30, 1992.

Funding: SARE Funding: $635,700 1988-1992. ACE Funding: $160,000 in 1991. Matching, $817,468

1993 SARE Grant Amount: $97,800 for one year.
1993 ACE Grant Amount: $164,200 for one year. Matching:

Organization	1988-92 SARE Funds	Matching Funds
University of Massachusetts	$118,000	$123,083
Rutgers, State Univ. of NJ	105,500	203,059
NY State Agricultural Experiment Station	39,500	47,945
Rodale Research Center	161,246	160,493
University of Vermont	144,954	121,167
Cornell University	66,000	90,760
Totals	$635,700	$746,507

LNE88-2: IMPROVING FARM PROFITABILITY BY EFFICIENTLY USING THE PASTURE RESOURCE

(Revised 4/14/93)

Major Participants:

University of Vermont: William Murphy (Project Coordinator), Sheep Farmer & Agronomist, College of Agriculture and Life Sciences, Dept. of Plant and Soil Science, Hills Building, Burlington, VT 05405-0082; conducts pasture production and management research and participates in farm walks and farmer workshops. James Welch, Animal Scientist & Farmer, conducts research on how much and what kind of concentrate should be fed to cows receiving all roughage from pasture; Nthoana Mzamane, Grassland Ecologist, conducts research on light relationships in pasture swards; Andrew Condon, Agricultural Economist, developing an economic model for incorporating pastures into farm feeding practices to maximize net return; Sidney Bosworth, Extension Agronomist, developing a computer program for estimating pasture forage mass, and incorporating agronomic, animal, economic and farm management information into fact sheets and meetings for farmers; Stewart Gibson, Dairy Extension Specialist, incorporating information provided by researchers into individual and group meetings with dairy farmers, fact sheets, and a computer program to provide guidelines for balancing rations for lactating cows on pasture.

West Virginia University: William Bryan, Agronomist, conducts pasture production and management research; Edward Prigge, Animal Scientist; collaborates in animal aspects of pasture research; Gerard D'Souza, Agricultural Economist, analyzes different

strategies for incorporating pastures into farm feeding programs to maximize net return.

State University of New York, Syracuse: Daniel Dindal, Soil Ecologist, conducts research on pasture soil organisms.

University of Massachusetts: Kent Fleming, Extension Economist, conducts pasture management research and provides information to farmers.

University of New Hampshire: William Zweigbaum, Farm Management Specialist.

Farmer Participants:

Vermont: John and Brent Brigham, dairy farmers (1990, 1991), and Tammy and Mike Hanson, dairy farmers (1992), provide advice on research needs and management strategies and financial and labor data for economic analysis, evaluate results, cooperate in on-farm grazing research, and participate in Extension efforts, including a video and farm walks.

Overview

Permanent pastures in the northeast United States typically have low productivity, producing only about two tons of moderate-to-poor-quality forage per acre during a three- to four-month grazing season. A proven method exists that enables these kinds of pastures to produce four tons or more of excellent-quality dry forage per acre during a six- to seven-month grazing season. The method is controlled grazing management, as described by Andre Voisin in 1959. The Voisin method, also known as short-duration grazing, intensive rotational grazing, and rational grazing, has been used for many years in New Zealand and for nine years in Vermont. New Zealand's highly productive and profitable agriculture depends almost entirely on permanent pastures that are grazed under controlled management. Voisin grazing management is a simple system of controlling grazing by dividing pastures into small areas (paddocks) that are grazed on a rotational basis, minimizing the waste of forage and protecting the plants from overgrazing.

In contrast, many American farmers use a system of zero pasturing or year-round confinement feeding that involves large amounts of purchased feed and supplements, often resulting in low profitability. Feeding of livestock in confinement can cost six times as much as it does on well-managed pastures. First-year costs of materials, maintenance, and labor for controlled grazing management range from $1,500 to $2,000 for a 40-cow herd. Its use has returned $3.75 in benefits for each $1 invested by dairy farmers.

This project proposes to assist farmers in the northeast in using Voisin grazing management and to study and refine the method for this region. It has been developed with

the active participation of dairy and sheep farmers, research scientists, Extension personnel, Soil Conservationists, and fencing industry representatives.

Investigators at the University of Vermont determined through work done from 1989-1990 that:

(1) The best method for estimating pasture mass was a bulk density rising plate, which was both inexpensive and easy to use;

(2) Plants recovered from grazing quicker, and net dry forage yield was greater during both years under sheep grazing alone (5,857 kg/na in 1989; 8,777 kg/ha in 1990), compared to cattle-grazed treatments (4,000 in 1989 and 3,117 in 1990);

(3) Sheep grazing increased soil levels of N and K, possibly reflecting more uniform dung distribution by sheep, compared to cows;

(4) Soil compaction was greater under cattle grazing than under sheep, and probably influenced numbers of soil organisms and limited plant growth;

(5) Soil CO_2 respiration was lower under cattle than under sheep;

(6) Soil nematode numbers were three times greater under sheep than under cattle;

(7) Cattle rejected forage around dung pats on 34% of the pasture area in 1989, and 40% of the area in 1990.

Results from 1991 and 1992 include the following:

- In studies that focused on the optimum grazing conditions for lactating cows, researchers found that in a grass/white clover pasture, cows should go into a fresh paddock when the forage is between six and eight inches tall, preferably after each milking. When the plants get much taller than six to eight inches, nutrients are wasted and taller plants start shading out others.

- Post-grazing treatments such as harrowing or soil aeration are not needed if grazing is appropriate and soil texture is not conducive to excess compaction by livestock.

- Grazing management can encourage the growth of white clover in the pasture.

- Supplements (based on estimates of cows' dry matter consumption on pasture at 1.5 percent to 2.25 percent of body weight) increased milk production, but their cost exceeded the value of the additional milk. Further experiments are planned to determine at what level concentrates would boost milk production

without diminishing profits, and whether reduced supplements would affect cows' body condition, breeding and milk production in the long term.

- The Hanson farm saved over $12,000 in feed costs by using Voisin-style grazing between late April and early November 1992. Similar savings were achieved at the John and Brent Brigham farm in 1991. The Brighams, of St. Albans, Vermont, were the on-farm cooperators in 1992.

Results of the West Virginia experiments indicate that in general, more cattle are supported with more and better quality forage when the sward is grazed starting at a height of six inches to remove 75% of the available forage.

The above information helps to understand the complex pasture-livestock interrelationship, which is essential for obtaining full potential benefits from feeding livestock on pasture.

In seven additional experiments concerning supplemental protein feeding of cows grazing pasture at the University of Vermont, total milk production was 11% higher during feeding periods of a high rumen undegradable intake protein (UIP), compared to the low UIP feeding period. Milk protein production also increased during these periods, but milk fat percent did not change. If an inexpensive ration adjustment in UIP produces an 11% increase in milk production from cows on pasture, a major economic benefit is possible, making use of pastures by dairy farmers much more attractive.

The financial effects of incorporating well-managed pastures into farm feeding programs are being studied using a representative sample of ten dairy farmers who are using controlled grazing management. Preliminary results indicate that net return to farmers' labor, management, and interest is about six times greater for medium size Jersey herds on pasture and purchased winter feed ($47,628), compared to similar size herds under year-round confinement feeding with no pasture and all feed produced on the farm ($7,729).

Two videos of approximately 30 minutes each have been produced by Perceptions, Inc., of Charlotte, VT, with introductions by Dr. Bill Murphy from the University of Vermont. The first one introduces pasture management and strives to motivate farmers to at least consider incorporating well-managed pastures into their feeding programs. The second video focuses on pasture forage utilization and controlling livestock with electric fencing.

Topics under continuing investigation are the social organization and grazing behavior of cows in a well-managed pasture system; the actual amount of forage that cows eat on well-managed pasture; soil organisms in well-managed pastures; and the long-term effects of Voisin-style grazing on overall farm profitability.

Objectives

(1) Determine sward dynamics, light relationships, net forage production, seasonal distribution, and effects of postgrazing grooming (harrowing, clipping, soil aeration) and manuring on white clover-grass swards, under various frequencies and intensities of dairy or beef cattle grazing.

(2) Determine effects of supplementing high levels of rumen undegradable intake protein and additional energy on milk production of cows receiving all roughage from pasture.

(3) Determine soil biota populations, microcommunity structure, fertility levels, and compaction under controlled-grazed pasture.

(4) Determine economics of incorporating well-developed, controlled-grazed pastures into dairy and beef farm feeding programs.

Project Duration: Five years, ending Dec. 31, 1993.

Funding: $537,265 SARE. Matching, $727,544.

1993 SARE Grant Amount: $121,058 (funding to completion of project).

Organization	Sustainable Agri. Funds	Matching Funds
University of Vermont	$403,041	$541,163
West Virginia University	93,864	119,919
State University of NY, Syracuse	22,840	48,942
University of Massachusetts	12,520	12,520
University of New Hampshire	5,000	5,000
Totals	$537,265	$727,544

LNE88-3: ROLE OF CEREAL GRAIN COVER CROPS IN NITROGEN MANAGEMENT FOR THE CHESAPEAKE BAY REGION

Major Participants:

University of Maryland: Russell Brinsfield (Project Coordinator), Agricultural Engineer, Wye Research Institute, P.O. Box 169, Queenstown, MD 21658.

University of Delaware: William Ritter, Agricultural Engineer, Newark, DE.

Pennsylvania State University: Les Lanyon, Agronomist, University Park, PA.

Rodale Institute: James Morgan, Executive Director, Emmaus, PA.

Overview

Recently, there has been increasing concern about the impact of agricultural chemicals on groundwater resources. This is particularly true in the Chesapeake and Delaware Bay watersheds. One of the most prevalent issues is that of groundwater contamination with nitrate originating from soil fertility management practices. Nitrate in groundwater results from leaching of applied nitrogen, either directly or indirectly, and thus represents the loss of a resource required for crop production. For grain production of corn, recommended fertilizer rates are based on utilization efficiencies of approximately 60 percent, however, suboptimum growing conditions can reduce the percentage of applied nitrogen which is utilized by the crop to much lower levels. These inefficiencies have been recognized for some time but until the recent development of environmental issues, the unused portion of applied nitrogen was largely neglected. The development of agricultural management systems which focus on strategies for reducing the loss of nitrogen from the root zone must be considered.

Historically, cover crops were used to reduce soil erosion, fix nitrogen, and provide a source of forage in integrated agricultural systems. Since 1945, the development of relatively inexpensive inorganic fertilizers, and the concurrent spatial separation of livestock and grain production, has caused a dramatic reduction in the use of winter cover crops. Although much of the recent research on cover crops has focused on the use of legumes to supply nitrogen for future grain crops, long before nitrogen was recognized as a problem in the environment, scientists had documented the ability of cereal grain cover crops to reduce the leaching of nitrate from the root zone. However, the successful integration of cereal grain cover crops into current cropping systems will require an understanding of the dynamics of cover crop nitrogen uptake and remineralization in order to minimize nitrogen losses to the environment while providing maximum benefit to following grain crops. The proposed project will bring together research, extension, and private agencies and farmers in a five-year coordinated effort.

The project will be a cooperative effort between the University of Delaware, University of Maryland, Pennsylvania State University, and the Rodale Institute. Nitrate leaching under different cover crop management systems including dairy manure and forage production, poultry manure and irrigation, and continuous corn will be considered. Selected management practices will also be evaluated on two farms in Maryland, two in Delaware and two in Pennsylvania (total of six) to promote the use of cereal grain (rye) cover crops in nitrogen management. Results from the on-farm research and intensive plot research will be used to assess the economic impact of the different cover crop management practices on the farming system.

Objectives

(1) Evaluate the management of cereal grain (rye) cover crops to reduce the leaching of nutrients to groundwater and to optimize nitrogen recycling on the farm.

(2) Evaluate the economic impact of cereal grain (rye) cover crops on the farming system.

(3) Develop on-farm research to promote the use of cereal grain (rye) cover crops as a tool for nitrogen management.

Project Duration: 1988-1990 (funding for two years given in 1988)

Funding: $150,000 in 1988. Matching, $111,576.

Organization	Sustainable Agri. Funds	Matching Funds
University of Maryland	$44,900	$40,281
Pennsylvania State University	35,184	15,256
University of Delaware	34,916	28,163
Rodale Institute	35,000	27,606
Totals	$150,000	$111,576

LNE88-4: WHOLE-FARM IMPLEMENTATION OF ALTERNATIVE AGRICULTURE PRACTICES FOR FIELD CROPS

(Revised 1/14/91)

Major Participants:

Western New York Crop Management Association Cooperative, Inc.: John R. Deibel (Project Coordinator), Manager, 21 South Grove Street, East Aurora, NY 14052, Phone: (716) 655-4353.

Cornell University: Stuart Klausner; Jane Mt. Pleasant; Thomas Scott, Agronomy Department, Emerson Hall; Elson Shields, Entomology Department, Comstock Hall, Ithaca, NY 14853.

Extension: Bruce Tillapaugh, Erie-Wyoming Agronomy Agent, 401 N. Main St., Warsaw, NY 14569; Dale Dewing, Agronomy Agent, Parkside Dr., Ellicottville, NY 14731.

Farmer Participants:

New York: Harold Blesy, Blesy Farms, Henrietta Rd., Springville, NY 14141; David Cobo, Cobo Dairy Farms, Dutch Hill Rd., West Valley, NY 14171; William Feasely, Feasely Farms, Church St., Eden, NY 14057; Carl George, Jr., Car-Bu Farms, Maple Grove Rd., Delevan, NY 14042; Dan Handy, Handy Farms, Inc., 3655 Eldridge Rd., East Aurora, NY 14052; Richard Janiga, Rich-A-Lu Farms, Two Rod Rd., East Aurora, NY 14052; Donald Kreher, Jr., Kreher Poultry Farms, 5411 Davison Rd., Clarence, NY 14031; Michael Walker, Frank Walker and Sons, Sprague Hill Rd., Falconer, NY 14733; Edwin and John Zittel, 7226 Taylor Rd., Hamburg, NY 14075.

Overview

The Western New York Crop Management Association (WNYCMA) is a grower-owned, non-profit cooperative providing on-farm consulting services to 115 farmers on 30,000 acres of field crops across seven counties in the region. Established in 1986, the program is designed to provide a complete service package resulting in the successful use of Best Management Practices on member farms, exclusively using land-grant-based recommendations for integrated pest management; on-farm nutrient management system; and cultural practices. Additionally the cooperative provides a most comprehensive crop enterprise data base program on each field in the program. Growers enrolled in this cooperative are presently implementing best management systems, and continue to explore new avenues to further develop systems which reduce dependence on chemically based inputs. This collective group also provides a working demonstration of the benefits, both economic and environmental, associated with alternative agriculture practices. A close working relationship with Cornell University and Cooperative Extension provides a mutual exchange of information benefiting members and non-members alike.

The WNYCMA participated in the LISA program's 1988 project year, and successfully established six on-farm demonstration projects. During 1990, the WNYCMA carried out another successful year of LISA activities, including a summer tour attended by 117 farmers and agency representatives, co-sponsored by Cornell University and several USDA agencies, geared to Integrated Crop Management and LISA demonstrations.

Objectives

Component

(1) Continue to establish unique and applicable field-scale trials using selected low-input strategies and variations on Crop Management Association farms.

(2) Monitor crop development and measure seasonal progress through intensive scouting programs implemented by the CMA.

(3) Measure yields, quality, and other factors and compare the practices using portable scales and/or small plot yield assessments.

(4) Develop an economic analysis of each practice.

Educational

(5) Hold co-sponsored field days at the field locations to demonstrate these and other related practices.

(6) Publish project findings and related information annually in booklet form for dissemination to growers in the CMA, the local region, New York State, and the northeast.

Whole-Farm Approach

(7) Develop a high-quality publication at the project's conclusion, outlining the transitional factors necessary to changing management practices toward reducing chemical input dependency.

(8) Continue to develop slide presentation materials and other audio-visual products to be used by interested educators across the region.

(9) Continue disseminating practice recommendations through extension publications, CMA newsletters, and other available media.

(10) Further expand the development of quality private sector services which align themselves with sustainable management practices and adhere to the land grant system of research and education.

Project Duration: June 1, 1990 - June 1, 1991

Funding: $16,000 in 1988; $20,000 in 1990; $20,000 in 1991. Matching, $60,527.

Organization	Sustainable Agri. Funds	Matching Funds
Western NY Crop Management Association Coöp, Inc.	$56,000	$51,241
Cornell University	--	9,286
Totals	$56,000	$60,527

LNE88-5: COVER CROPS FOR NEW ENGLAND VEGETABLE GROWERS: ON-FARM RESEARCH, ECONOMIC ANALYSIS AND OUTREACH

(Revised 4/3/91)

Major Participants:

New Alchemy Institute: Ralph DeGregorio (Project Coordinator), Research Director, East Falmouth, MA, Phone: (508) 564-6301, research, outreach. Mark Schonbeck, Ph.D., Researcher, research, outreach; David Simer, M.S., RPE, Researcher, Entomologist, research.

University of Massachusetts: Stephen Herbert, Ph.D., Extension Agronomist, Dept. of Plant and Soil Sciences, Amherst, MA, research, outreach; Kent Fleming, M.A., IPM Economist, Dept. of Agricultural & Resource Economics, economic analysis.

Maine Organic Farmers and Gardeners Association (MOFGA): Eric Sideman, Ph.D., Technical Services, Augusta, ME, research, outreach.

University of Connecticut: Karl Guillard, Ph.D., Dept. of Plant Science, Storrs, CT, nitrogen analysis, statistics.

Overview

As integral components of sustainable agriculture, cover crops can reduce soil erosion and control weeds. In addition, legume cover crops such as hairy vetch will also reduce farmers' inputs of nitrogen feritilizer. Legumes have been shown to be effective cover crops in warm climates, but perceived establishment and hardiness problems have limited their utilization in New England.

These investigators have conducted cover crop experiments with lettuce, no-till sweet corn and no-till as well as conventionally tilled broccoli on New England vegetable farms.

Weed dry weights in lettuce plots were the lowest when a buckwheat/rye cover crop was used. A no-till, no-herbicide system of growing broccoli, where rye or oats plus a legume were established then mowed and left in place as mulch prior to planting the seedlings, yielded heads roughly three times as heavy and twice as large as did broccoli following rye alone. Mulches from the grass + legume cover crops released significant nitrogen (N) to the broccoli, as foliar N levels were higher than with rye mulch. Weed suppression was more effective with the grass + legume combination than with rye alone.

When sweet corn was planted without tillage in fields where rye or rye + bigflower vetch were established and then mowed, the residue of rye + vetch resulted in significantly better early-season weed control and greater corn yield than did rye alone. Studies are in progress on optimum seeding and mowing dates for rye + hairy vetch cover crops.

Education and outreach activities include a distribution of about 850 free cover crop seed kits with inoculant and instructions, presentations at several conferences and events, and publication of results in two journals. In addition, two replicated experiments were implemented on seven commercial farms to help demonstrate to farmers the effectiveness of these cover cropping systems.

Future experiments will compare these cover crop systems with conventional methods as well as study various mechanical and chemical management systems for cover crop species.

Objectives

(1) To conduct on-farm research onto cover crops which control erosion, suppress weeds, add nitrogen, and can be adopted by New England vegetable growers.

(2) To collect on-farm economic data for use in enterprise budgets that compare the economics of conventional and alternative cover crops.

(3) To extend information on cover crops to New England vegetable growers.

Narrative

This report summarizes progress by the New Alchemy Institute (NAI), the University of Massachusetts, the Maine Organic Farmers & Gardeners Association, and the University of Connecticut on cover crops to February 25, 1991.

During the above period, NAI completed cover crop experiments with lettuce in Massachusetts and Vermont (three locations, no-till sweet corn in Massachusetts and Connecticut, and no-till broccoli in Massachusetts). We know of no other data on biologically fixed nitrogen from New England for the four winter annual legumes reported here. Evidence is also presented that vegetable yield, weed suppression, and total cover crop nitrogen associated with these legumes mixed with rye, can be significantly greater than with a rye

monoculture, which is the standard in New England. Also, rye + a legume had biomass greater than or equal to rye alone. Reduced tillage is promising, including mow-killing certain legumes, but invertebrate pests may be a problem due to absence of tillage, presence of mulch, or both. Though bigflower vetch contains less nitrogen than hairy vetch, it did not interfere with late-planted sweet corn and did reseed itself, especially where perennial weeds and vertebrate grazing were less severe. Our results also support the common practice among organic growers of using buckwheat as a summer cover crop.

Experiments on time of seeding and mowing, nitrogen fertilizer equivalent of hairy vetch, and other factors have been completed. Results are being analyzed and manuscripts prepared; a progress report to USDA is due February 15, 1991. Vegetable crops have been overseeded with cover crops: this practice appears promising where vegetable crop spacing and population permit on fine-textured soils, or if seed is incorporated on coarser soils. On the Maine-Canadian border, thirteen hairy vetch strains from a number of countries have been planted. As a result of our efforts and those of the USDA, the US Germplasm Collection of hairy vetch is larger than in 1988, and includes one of the two hardiest strains mentioned in a report from the USSR.

The nineteen NAI research and demonstration sites in five states in 1989 include a fairgound, four field-day sites, a seed company, and an Audubon working farm. About 850 cover crop kits have been given away by NAI since mid-1988. Kits now consist of seed of the hardiest cultivar of hairy vetch and best inoculant known to us, rye seed, complete instructions with our phone number, and a self-addressed stamped postcard, all in a resealable plastic bag. Recipients are asked for their names, addresses and phone numbers so that we can follow up if cards are not returned.

Two posters were made and displayed at several meetings and at NAI. At least 5,000 people visit NAI each year; detailed signs and self-guided tours allow people to see our experiments and demonstrations; our workshops and publications are also available (our free catalogs were distributed at meetings and offer cover crop publications written by us and others). Video footage of our hairy and bigflower vetch experiments and interviews with NAI researchers was shot in 1989 by a LISA-funded filmmaker, and Canadian filmmakers visited to consult us about a video on the same subject. An hour-and-a-half workshop on weed suppression by cover crops and another on weed suppression in general which included cover crops, was videotaped, part of which is being sent to TV stations, and is being supplied to the public by a regional farmers' organization. We responded to requests for information by mail, telephone (including calls collect to us), and from visitors. A number of presentations have been given and articles published, and ten interns/volunteers whose principal responsibilities were cover crop research/outreach were trained.

We stimulated the bulk ordering of cover crop seed by a grower organization, and provided technical assistance for the second year, increasing local availability while reducing seed cost by about 10% (6 tons of cover crop seed, including hairy vetch, were cooperatively ordered in one year). We have worked to stimulate local hairy vetch and rye seed production

in ME, NH, MA and NY to reduce the high cost of shipping seed from the West. A review of relevant economic literature was completed and made available to the cooperating economist, who has prepared enterprise budgets for rye vs. hairy vetch. These budgets suggest hairy vetch nitrogen is cost-effective. Our work also suggests that savings in herbicide cost by using a hairy vetch and rye cover crop, mow-killing it, and planting no-till broccoli into it can be substantial.

Project Duration: One year: June 1, 1990 - June 1, 1991

Funding: $50,000 in 1988; $80,000 in 1989; $40,000 in 1990. Matching, $256,207.

Organization	Sustainable Agri. Funds	Matching Funds
New Alchemy Institute	$103,000	$165,150
University of Connecticut	3,780	11,352
Maine Organic Farmers and Growers Association	11,260	6,125
University of Massachusetts	51,960	73,580
Totals	$170,000	$256,207

LNE88-6: NORTHEASTERN DAIRY FARM FORAGE DEMONSTRATION PROJECT

Major Participants:

Cornell Cooperative Extension: Joan Sinclair Petzen (Project Coordinator), Agriculture Program Leader, Cattaraugus County, P.O. Box 870, Ellicottville, NY 14731, Phone: (716) 699-2377. Dale R. Dewing, Cornell Cooperative Extension Associations of Cattaraugus and Chautauqua Counties.

Seneca Trail Resource Conservation & Development: Edward Rayburn.

Alfred State College: Ronald Stutzman.

Overview

Over the last ten years, intensive rotational grazing has been found to be a low-cost means of producing high-quality forage. The majority of pasture in the northeast, however, is

grazed continuously, resulting in sparse regrowth, many weeds, and low nutrient value due to overgrazing. This has led to a bad reputation for pastures as a whole.

This project uses a whole-farm approach to assess the input reduction and profitability of a year-round forage management system which includes the use of intensive rotational grazing systems on small and mid-sized farms. Harvest management reduces the need for chemical weed control and fertilizers, and soil and water quality are enhanced because fewer acres need to be plowed. This reduces energy utilization and machinery costs, as animals are used to harvest about fifty percent of the forage.

Specific achievements during the first two years of funding include development of:

- techniques for effectively sampling fresh forage in the field for analysis,
- a pasture plate for estimating tons of available forage dry matter from a pasture using a bulk height measurement,
- a data base of fresh forage analysis results from two years for protein, energy, and minerals; "Dairy Pasture Ration Balancer" computer program with user's guide,
- a workshop format for introducing dairy producers to intensive rotational grazing, and
- a seminar-tour about this grazing method for dairy professionals.

Currently being completed are development of calibration equations for near infrared (NIR) analysis of fresh forage, whole farm economic case studies of four farms using rotational grazing techniques, and in vivo analysis of some fresh forage samples to determine rates of digestion. Future plans for this project include further refinement of the forage analysis and feeding recommendation components, as well as demonstration of forage harvest options for the stored forage component of a year-round farm system.

Objectives

(1) To expand the fresh forage analysis data base that has been developed by this project to improve its accuracy, and verify calibration equations for near infrared (NIR) analysis of fresh forage samples. Producer sampling and handling techniques for fresh forage analysis will be tested and verified.

(2) To refine feeding management recommendations for supplementing dairy cows to maximize milk production and maintain body condition while using pasture.

(3) To further farmers' and agribusinessmen's understanding of pasture and harvest management in order to maximize forage production and availability to the dairy cow

during the pasture season, and allow for adequate high-quality stored forage to be harvested in a timely manner for use during the winter.

Project Duration: Three years

Funding: $10,000 in 1988; $45,000 in 1989; $30,000 in 1990. Matching, $197,170.

Organization	Sustainable Agri. Funds	Matching Funds
Cornell Extension	$60,433	$134,825
Seneca Trail RC & D	24,567	8,155
USDA/Soil Conservation Service	--	29,360
Demonstration Farms	--	24,830
Totals	$85,000	$197,170

LNE88-7: WEED CONTROL IN REDUCED TILLAGE CROPPING SYSTEMS: USE OF OVERSEEDED COVER CROPS

Major Participants:

Rodale Research Center: Rhonda R. Janke (Project Coordinator), Agronomy Coordinator, Kutztown, PA 19530; Weed Ecologist; supervises agronomic research at Rodale and midwest on-farm research, will conduct research project at the PA site and supervise local on-farm research.

Maine Cooperative Extension: Richard Kersbergen, Walter Quality Specialist, Belfast, ME 04915; Extension Educator; will assist with research and demonstration on the Neves farm in Maine.

Maine Dept. of Agriculture: Russell W. Libby, Research Director, Food & Rural Resources, Augusta, ME 04330; Agricultural Economist; will analyze economic data.

University of Maine: Matt Liebman, Sustainable Agriculture, Orono, ME 04469; Weed Ecologist, coordinator, Maine Sustainable Agriculture Program, will conduct research projects at the University of Maine (Rogers Farm) and the Neves Farm.

Cornell University: Peter L. Marks, Section of Ecology and Systematics, Ithaca, NY 14853; Research/Administration; liaison to the Cornell University administration and adviser to this project. Charles L. Mohler, Research Associate, Ecologist; developed and conducts the research project in NY, assists with major weed censuses at Rodale and will coordinate data analysis.

USDA/ARS: John R. Teasdale, Plant Physiologist, Weed Science Laboratory, Beltsville, MD 20705; Weed Scientist; plans and conducts research at the Beltsville site.

Farmer Participant:

Anthony Neves, Freedom, ME 04941, grows dry beans and wheat.

Overview

Technologies are urgently needed by farmers for ecological weed control in cropping systems that allow them to conserve soil and water resources and observe conservation compliance guidelines. The principles tested in these unique systems include shading weeds with standing cover crops, smothering weeds with mown cover crops, and generally preempting the niches that weeds tend to fill when the ground is left bare, as in conventional cropping systems. In this project, collaborators at four locations spanning the climatic range of the northeastern US are performing experiments to determine the feasibility of controlling weeds in no-till and reduced-till cropping systems with the use of fall-sown cover crops.

The work at Cornell University is focused on developing no-till grain and soybean production systems without the use of herbicides. The basic strategy is to use relay cropping to keep weeds suppressed by crop competition. They are also exploring methods for improving establishment of aerially overseeded crops. Preliminary results indicate that direct overseeding of winter grains into standing corn can approach commercial yields, even under less than ideal weather conditions.

Although buckwheat is notoriously hard to establish by surface sowing, both pelletized and presoaked buckwheat seed established well. Unfortunately, subsequent growth was poor, apparently due to competition rather than to soil or weather conditions.

Establishment success of aerial overseedings into corn and beans tends to be inconsistent between years and even from one part of a field to another. Several satellite trials run to test methods for improving establishment of oversown small grains and legume cover crops indicated that pelletizing the seed of buckwheat and spring barley (Birka) greatly improved the germination of both species in all watering regimes. Weed control by rye mulch was very good.

In experiments conducted at USDA/ARS in Beltsville, MD, investigators found that planting corn in 15-inch rows rather than the standard 30-inch rows improved performance of

low-input treatments. Use of higher corn plant densities may be an effective safeguard against years when cool, wet soils predominate and can provide additional competition for weed suppression.

Rye as a cover crop appears to suppress soybeans, dry beans, and corn. One of the highest-yielding treatments was corn no-till planted into hairy vetch (not significantly different from conventional treatments). Weather conditions and soil drainage properties play a large role in achieving success with cover crops.

The Low-Input Reduced Tillage experiment at Rodale Research Center is attempting to combine what farmers are learning about reduced tillage, ridge tillage, and especially no-till (mow-sow) planting into cover crops with what has been learned about how to grow crops without purchased fertilizer or pesticides. Once the experiment has gone through one or two rotation cycles and the tillage systems are well established, this trial will be a valuable testing ground where agronomic questions can be answered about system feasibility, and energy and economic comparisons can be calculated from a realistic, multi-year data set.

Objectives

(1) Develop reduced-tillage systems without herbicide that provide adequate weed control, reasonable yields, and improved net profits for farmers. Such systems will eliminate risk of groundwater contamination from herbicides.

(2) Use mulch and relay cover crops to significantly reduce the establishment of annual and perennial weed seedlings and the spread of perennial weeds from vegetative propagules.

Project Duration: Three years

Funding: $27,000 in 1988; $80,000 in 1989; $20,000 in 1990. Matching, $123,056.

Organization	Sustainable Agri. Funds	Matching Funds
Rodale Research Center	$26,163	$45,658
Cornell University	50,842	29,789
USDA/ARS, Beltsville	14,421	14,914
University of Maine	35,574	32,695
Totals	$127,000	$123,056

LNE88-8: IMPLEMENTATION OF ELECTRONIC DECISION SUPPORT TECHNOLOGY FOR APPLE PRODUCTION

Major Participants:

Pennsylvania State University: Edwin G. Rajotte, Dept. of Entomology, Grant Administrator; Wesley Musser and Carolyn Sachs, Dept. of Agricultural Economics and Rural Sociology.

University of Vermont: Lorraine Berkett, Dept. of Plant and Soil Science.

University of Massachusetts: Daniel Cooley, Dept. of Plant Pathology, Extension Plant Pathologist.

Rodale Research Center: Sarah Wolfgang, Project Leader/Orchard.

Cooperators:

Pennsylvania State University: Timothy Bowser, Dept. of Agricultural Economics and Rural Sociology; Robert M. Crassweller, Dept. of Horticulture; Larry A. Hull, Dept. of Entomology; James W. Travis, Dept. of Plant Pathology.

University of Vermont: Patricia Downer, Dept. of Plant and Soil Science, Research Computer Specialist.

Rodale Research Center: Kim Kroll, Agricultural Systems Modeler.

Overview

Agricultural production has evolved into a complex business requiring the accumulation and integration of knowledge and information from many diverse sources, including marketing, horticulture, management of insects, diseases and weeds, accounting and tax laws. Because high-quality information has not been easily accessible to growers when they are faced with important management decisions, decision-making on the farm has been surrounded by a high degree of uncertainty. To compensate, farm managers have increased inputs of chemical pesticides and fertilizers in an effort to minimize the variability in yield and quality that can occur from year to year. The price of this strategy, however, is reduction in potential profit and an increased threat to the environment because of the overuse of fertilizers and pesticides.

This project proposes to create a mechanism to incorporate electronic decision support technology (initially Expert Systems) into commercial apple production in the northeast. Expert Systems and associated electronic technology have considerable potential for low-input

agricultural production in organizing and integrating information, knowledge and managerial skills necessary to profitably reduce purchased inputs.

The Penn State Orchard Consultant (PSOC) has been developed to help apple growers make better decisions about production and pest management. It has recently been made available for sale to fruit growers in Pennsylvania through Pennsylvania State Cooperative Extension. The system integrates various facets of apple production and gives the apple grower the information necessary to reduce some purchased inputs by substituting high-quality, integrated information derived from three sources: state-of-the-art apple production and IPM knowledge; site specific, farm-level data; and weather records. A primary emphasis of this system is to decrease the detrimental environmental impacts associated with pesticide and fertilizer use as well as input costs, thereby improving farm profitability and reducing economic risk.

A fieldtest and evaluation of the Expert System was conducted during eight months of the 1988 and 1989 growing seasons, using a pilot test group of twenty-six apple growers. During this time, the economic impact of the system on cooperators' operations and net income was estimated using an economic survey questionnaire, and the results of this study are still being analyzed.

This study has provided some preliminary evidence that changes in usual production practices occur as growers and users substitute information for purchased inputs, in this case, pesticides. It was also demonstrated that the substitution of information for inputs was stimulated by the Expert System, which enabled the grower or user to collect, integrate, and interpret the information rapidly. More work will need to be done at the first stage of the diffusion process if the Orchard Consultant is to become an effective tool for sustainable agriculture. Specifically, the diffusion agency must provide new educational programming for the growers on its application.

Objectives

(1) Expand and modify field evaluation of Expert System technology in Pennsylvania.

(2) Analyze farm-level economic impacts.

(3) Develop modules and modify existing modules for New England and organic production; to be performed by the Universities of Vermont and Massachusetts and the Rodale Research Center.

Project Duration: Two years

Funding: $55,000 in 1988; $55,000 in 1989. Matching, $79,990.

Organization	Sustainable Agri. Funds	Matching Funds
Pennsylvania State University	$80,000	$74,511
Rodale Research Center	9,000	5,479
University of Massachusetts	10,500	--
University of Vermont	10,500	--
Totals	$110,000	$79,990

LNE88-9: ALTERNATIVE CROPPING SYSTEMS FOR LOW-INPUT AGRICULTURE IN THE NORTHEAST

(Revised 1/14/91)

Major Participants:

Cornell University: Jane Mt. Pleasant (Project Coordinator), Agronomy Department, Ithaca, NY 14853, Soil and Cropping System Management, 60% Extension, 40% Research; as project coordinator, oversees field experiments, on-farm demonstrations/research, and extension activities in NY, coordinates NY and PA components of the project; Thomas Scott (Project Coordinator), Agronomy Department, Soil Fertility, 40% Research, 60% Teaching, former Extension Agronomist, oversees field experiments in NY and provides expertise on interseedings and cover crops in corn and soil fertility management; Gary Bergstrom, Plant Pathology Department, 70% Extension, 30% Research, Biology and Management of Field Crop Diseases, provides expertise for field experiments on crop diseases and their interactions with cropping systems, assists with development of extension activities in NY; Bill Cox, Agronomy Department, 70% Extension, 30% Research, Corn/Small Grain Management, provides expertise for field experiments on effects of tillage on crop growth and development, helps design and implement on-farm research in the state, assists with development of extension activities in NY; Paula Davis, Agronomy Department, Research; John Duxbury, Dept. of Soil, Crop and Atmospheric Sciences, Research; Elson Shields, Entomology Department, Applied Entomology, 70% Extension, 30% Research, provides expertise for field experiments on relationships between insect damage and cropping systems, assists with development of extension activities in NY; Stu Klausner, Senior Extension Associate, Agronomy Department, 55% Extension, 45% Research, Soil Fertility, provides expertise for field experiments on fertilizer and manure management, assists with development of extension activities in NY; Harold van Es, Agronomy Department,

70% Extension, 30% Research, Water Management and Soil Conservation, provides expertise for field experiments on effects of cropping systems on soil physical properties, assists with development of extension activities in NY; Keith Waldron, IPM Coordinator, Dairy-Field Crops, Comstock Hall, provides pest management expertise for development of extension activities in NY; William Waltman, Senior Extension Associate, Agronomy Department, provides expertise in relating soil properties to crop growth and development in field experiments, Soil Interpretations and Land Use; Richard Zobel, Research Plant Geneticist, USDA, Agronomy Department, Root Genetics and the Soil Environment, provides expertise for field experiments on soil environment/root relations (Steering Committee member).

Western NY Crop Management Association Cooperative: John Deibel, Manager, 21 South Grove Street, East Aurora, NY 14052, represents farmers' interests in research and extension projects, designs and implements on-farm demonstrations in Erie-Wyoming Counties.

Cornell Cooperative Extension: Agents represent farmers' interests and concerns and help implement on-farm demonstrations in their respective counties. Tom Kilcer, Field Crops Agent, Rensselaer County, County Courthouse, Congress and 2nd Streets, Troy, NY 12181; Jeff Miller, Field Crops Agent, Oneida-Herkimer Counties, P.O. Box 271, Herkimer, NY 13350, also helps design on-farm demonstrations; Jim Capron, Field Crops Agent, Wayne County, 480 N. Main Street, Canandaigua, NY 14424; Mark Brown, Agricultural Consultant for Empire Agri-Services, Newark, NY, also helps design on-farm demonstrations; Elaine Dairymple, Field Crops Agent, Schuyler County, Rural-Urban Center, 208 Broadway, Montour Falls, NY 14865, also helps design on-farm demonstrations; Bruce Tillapaugh, Field Crops Specialist, Erie-Wyoming Counties, 401 North Main Street, Warsaw, NY 14569, represents farmers' interests and needs in research and extension projects, coordinates on-farm demonstration/research in Erie-Wyoming Counties.

Rodale Research Center: Rhoda Janke, Agronomy Coordinator, RD #1, Box 323, Kutztown, PA 19530, Agronomy, Weed Science, oversees cropping systems research at Rodale and coordinates on-farm research in PA. Steve Peters, Agronomy, implements field research in PA.

Pennsylvania State University: Wesley Musser, Agricultural Economics and Rural Sociology, Weaver Building, University Park, PA 16802, 75% Research, 25% Teaching, Farm Management and Finance and Natural Resource Economics, provides economic analysis of field experiments and on-farm demonstration/research; Sprio Stefano, Agricultural Economics and Rural Sociology, 75% Research, 25% Teaching, Production Economics, Quantitative Methods and Natural Resource Economics, provides economic analysis of field experiments and on-farm demonstration/research.

Farmer Participants:

Provide input (ideas) and sites for on-farm trials.

New York: Ed Gates, Box 2, Montour Falls, NY 14865; Warner Luenberge, Rt 26, Oriskany Falls, NY 13425; Norman Vaill, Poplar Ridge, Aurora, NY; Robert Lannon, field-scale trials. David Shaul, Box 5, Fultanham, NY 12071, represents farmer's interests and concerns in design of research and extension projects, provides site for on-farm research; Calvin De Golyer, Dairy Farmer, Table Rock Farms, 5554 De Golyer Road, Castile, NY 14427, represents farmers' interests and concerns in extension and research components of the project, designs and provides site for trials on-farm in Wyoming County.

Pennsylvania: Kenny Gehringer, RD #2, Box 243, Kutztown, PA 19530; Gordon Gruber, RD #1, Kutztown, PA 19530.

Overview

Continuation of an ongoing LISA extension and applied research program is proposed to provide farmers with crop production practices that reduce chemical inputs, and conserve energy and natural resources while sustaining agricultural profitability. Cooperating institutions are Cornell University, Rodale Research Center, Pennsylvania State University and USDA/ARS. Field experiments in New York and Pennsylvania provide the foundation for an extension program and an interdisciplinary research effort in low-input agriculture.

The research program consists of ongoing long-term experiments in New York and Pennsylvania that provide data for the extension program. The experiments concern cropping systems based on alternative practices. These experiments allow evaluation of the effects of alternative systems on nutrient utilization, crop growth, the soil-root environment, pest levels, soil cover and farm profits.

The extension program consists of: 1) field-scale trials in which conventional practices are compared with alternative practices; and 2) an educational program directed at farmers and extension agents which presents information from past and ongoing research that can be used in sustainable cropping systems.

Funding is requested for an additional three years in order to develop a significant data base from the on-farm trials and to allow the long-term experiments to complete one crop rotation cycle.

Objectives

The overall objective is to develop an extension and applied research program that provides farmers with viable crop production practices that reduce off-farm inputs while

maintaining productivity and conserving the natural resource base. Considerable research data on individual components of reduced-input systems (i.e. tillage, manure management, interseeding and cover crops) is available, but research integrating these practices into a cropping management strategy is lacking. Extension programs have not been developed to present low-input systems to farmers.

Specific objectives of the extension program are to:

(1) Establish field-scale trials comparing conventional with low-input practices;

(2) Review, consolidate and extend to farmers and county extension agents information from past and ongoing research on alternative cropping systems which maintain net farm income;

(3) Continue field-scale trials comparing conventional with low-input practices; and

(4) Review, consolidate and extend to farmers and county extension agents information from past and ongoing research on alternative cropping systems which maintain new farm income.

Specific objectives of the research program are to:

(5) Determine effects of alternative cropping systems under several tillage, weed control, manure and cover crop practices on nutrient utilization, crop growth, and changes in soil cover, pest levels, and the soil-root environment;

(6) Utilize information on N dynamics within different cropping systems to maximize the supply of N to crops while reducing losses from the soil-plant system; and

(7) Evaluate effects of alternative cropping systems on transitional and steady state farm income for representative farms. This research is intended to increase our understanding of cropping practices and the mechanisms of their interactions so that we can improve the efficiency and sustainability of cropping systems. Results from this research with implications for additional research outside the scope of this project are and will be thoroughly explored by these cooperators in concomitant research funded by other sources.

Project Duration: Four years

Funding: $60,000 in 1988; $80,000 in 1989; $100,000 in 1990; $71,152 in 1991. Matching, $504,278.

Organization	Sustainable Agri. Funds	Matching Funds
Cornell University	$202,190	$361,956
Rodale Research Center	66,239	61,524
Pennsylvania State University	42,723	79,798
Totals	$311,152	$504,278

LNE88-10: DEVELOPMENT, EVALUATION AND IMPLEMENTATION OF LOW-INPUT SYSTEMS FOR EASTERN VINEYARDS

Major Participants:

Cornell University: David M. Gadoury (Project Coordinator), Dept. of Plant Pathology, NY State Agriculture Experiment Station, Geneva, NY, 14456, Phone: (315) 787-2328. R.C. Pearson and R.C. Seem, Dept. of Plant Pathology; R.M. Pool, Dept. of Horticultural Sciences; T. Henick-Kling, Dept. of Food Science and Technology; T. Dennehy and J. Nyrop, Dept. of Entomology.

Pennsylvania State University: M.C. Saunders, Dept. of Entomology; J.W. Travis, Dept. of Plant Pathology; C.W. Haeseler, Dept. of Horticulture.

Overview

This proposal addresses the need to reduce costs in the three most expensive aspects of grape production in the northeast region: disease and insect management, pruning, and ground cover management. Previous work by the various cooperators has demonstrated that substantial savings can be made in all of these areas. Major reductions in seasonal fungicide use have been achieved in experiments involving the use of dormant treatments to destroy overwintering pathogens. The use of insect mating hormones (pheromones) has been shown to be effective in controlling grape berry moth in certain vineyards without the use of insecticides. Mechanical pruning and minimal hand pruning have greatly reduced labor costs in these operations. Finally, new approaches to ground cover management have eliminated or greatly reduced the need to till vineyards. The experiments outlined in this proposal are designed to provide the critical information that will allow the most promising grape production strategies to be combined into a truly low-input system for grapes in the northeastern United States.

Objectives

(1) Refine the technique of using dormant eradicant sprays, thereby making it an effective, practical method to replace or augment seasonal fungicide sprays.

(2) Conduct large-scale demonstrations of the effectiveness of the grape berry moth pheromone and compare the effectiveness of the GBM pheromone with that of conventional insecticides.

(3) Illustrate that secondary pests seldom cause economic damage to processing grapes.

(4) Develop an optimal vineyard design and management plan for low-input systems.

(5) Generate and deliver a weather forecast with a high spatial resolution (1 km) to be used for local management decisions on pest development, cultural management, and timing of pesticide applications.

Project Duration: Two years

Funding: $40,000 in 1988; $39,000 in 1989. Matching, $113,520.

Organization	Sustainable Agri. Funds	Matching Funds
Cornell University	$46,865	$98,524
Pennsylvania State University	32,135	14,996
Totals	$79,000	$113,520

LNE88-11: TAKING CHARGE: STRATEGIES FOR SUSTAINABLE AGRICULTURE IN THE NORTHEAST (VIDEO PRESENTATIONS)

(Revised 4/14/93)

Major Participants:

Rodale Institute: James 0. Morgan (Project Coordinator), Vice President and Executive Director, 222 Main Street, Emmaus, PA 18049; Rob Roy Frederick, MD.

Cooperators:

Connecticut: Steve Kaffka, Sunny Valley Foundation, New Milford, CT.

Delaware: Joanne Whalen, Extension Agent, Dover, DE.

Maine: Matt Liebman, Sustainable Agriculture Specialist, Orono, ME.

Maryland: Robin Haggie, Chesapeake Wildlife Heritage, Easton, MD; Garth Youngberg, Institute for Alternative Agriculture, Greenbelt, MD.

Massachusetts: David Ferro, Extension Entomologist, Amherst, MA; Ron Prokopy, Extension Entomologist, Amherst, MA.

New York: Martin Culik, Extension Agent, Canandaigua, NY; Judy Green, Alternative Agriculture Specialist, Ithaca, NY; Mike Kane, President, NOFA-NY, Port Crane, NY.

Vermont: Bill Murphy, University of Vermont, Burlington, VT.

Farmer Participants:

Pennsylvania: Bob Anderson, V.P., Walnut Acres, Penn's Creek, PA; Murray McJunkin, Grain and Hog Farmer, Bellefonte, PA.

Vermont: Austin C. Cleaves, Dairy Farmer, East Montpelier, VT; Paul Harlowe, Vegetable Grower, Bellow Falls, VT.

Massachusetts: Maurice Tougas, Fruit/Berry Grower, Northborough, MA.

Overview

Experience has shown that farmers are reluctant to attempt a transition to a lower-input method of farming unless they have the opportunity to study other farmers' methods in a firsthand manner. Travel to a wide variety of sites where sustainable agriculture systems have been implemented is impractical for most farmers. We propose to make use of video technology to bring many farmers into contact with a wide range of methods. The material presented will be the firsthand experiences of farmers, findings from farm-based or farm-simulated research projects throughout the northeast, and the perceptions of various low-input specialists within the agricultural community. An accompanying 12-page study guide will be prepared to provide farmers with a distillation of the options presented in the video and with a list of additional sources of information. The videos will be available for distribution by March 1, 1990.

Objectives

(1) Use video technology to offer northeastern farmers encouragement, ideas and reliable information about making a transition to a lower input system.

(2) Address separately the needs of northeastern farmers of two distinct kinds: a) the large-scale field crops and/or livestock farmer, and b) the high-value fruit, vegetable and ornamental growers.

(3) Address in separate, sequential programs two distinct needs for each of the two kinds of farmers: a) encouragement and b) reliable information.

(4) Complement the motivational and informational role of the videos by providing a simple study guide that will assist in the farmers' decision-making process.

(5) Create an avenue for personal assistance by providing the viewer with an address and telephone number for additional advice and information.

(6) Distribute the video presentations and the study guides through multiple outlets for maximum effective coverage of the farming community.

Results

This project produced six videos that profile the progress farmers have made toward sustainable agriculture. The series, released in 1992, documents the methods farmers have developed to reduce or eliminate the use of purchased inputs. Photographed during the course of an entire growing season, the series was produced with the help of nearly 200 farmers and other experts. It was shot in a 12-state area in the Northeastern and Mid-Atlantic regions of the U.S.

There are six videos in all: "Field Crops," "Rotational Grazing," "Vegetables," "IPM for Vegetables & Small Fruits," "IPM For Apples," and "High-Value Marketing." Each runs for approximately 30 minutes, and features audio and video footage almost exclusively of farmers and farm-field operations.

Accompanying the series is a "Resource and Viewing Guide" that provides basic background on the subject matter of each individual video. Together, the videos and printed guide are aimed at providing an introduction to sustainable agriculture for farmers, researchers, policy makers, Extension staff and other interested people.

A goal of the videos was to offer northeastern farmers encouragement, ideas and reliable information about making a transition to a lower-input system. The comments and advice focus almost exclusively on switching from chemical-intensive production methods to those relying on minimal or zero purchased chemicals.

They address separately the needs of northeastern farmers of two distinct kinds. "Field Crops" and "Rotational Grazing" are geared to large-scale agronomic crop and/or livestock farmers, while "Vegetables," "IPM for Vegetables & Small Fruits," "IPM For Apples" and "High-Value Marketing." serve growers of horticultural crops.

The farmer comments provide practical, how-to information as well as the kind of encouragement and inspiration borne of first-person experience. Comments from researchers, Extension staff and other technical experts strengthen the scientific reliability of the message.

Rodale and Rooy Media, which produced the videos, are working to distribute the video presentations and the study guides through multiple outlets for maximum effective coverage of the farming community. In addition to meeting the grant requirements for complimentary distribution of the videos, Rodale Institute and Rooy Media have teamed up to promote them to many audiences. Rodale Institute advertises the videos periodically to the 50,000-plus readers of its national farm magazine, The New Farm. The Institute also promotes the videos in direct-mail marketing efforts to its 23,000 book customers. Rooy Media prepared an attractive brochure about the videos and mailed it to 11,000 professors, librarians, high school teachers and Cooperative Extension personnel.

Project Duration: Two years

Funding: $10,000 in 1988; $60,000 in 1989. Matching, $153,468.

Organization	Sustainable Agri. Funds	Matching Funds
Rodale Institute	$70,000	$153,468
Totals	$70,000	$153,468

LNE89-12: RUMINANT ANIMAL PRODUCTION USING TYFON FORAGE BRASSICA

(3/12/91)

Major Participants:

University of Maine: Mary Wiedenhoeft (Project Coordinator), Agronomy, Dept. of Plant and Soil Science, Orono ME 04469. Barbara Barton, Manager of Dairy Research, Purina

Mills, Inc., St. Louis, MO; Robert Hough, Assistant Extension Educator and Livestock Specialist; Rupert Stafford, Assistant Agronomist.

University of Connecticut: Karl Guillard, Assistant Professor in Residence, Agronomy, Stoors, CT 06268.

USDA/Soil Conservation Service: Phil Burns, Economist; Christopher Jones, Conservation Agronomist, graduate student.

Farmer Participants:

Connecticut: Dave Albert, Farm Manager, Sugar Hill Farm, Colebrook, CT.

Maine: David DeGrandpre, Farm Manager, Wolfe's Neck Farm: Coordination of projects and Small Farms Field Day; Janet Perry, sheep farmer, Ashland, ME: Growth trial with market lambs; Mark Russell, dairy farmer, Litchfield, ME: Growth trial with dairy (Jersey) heifers; Tom Settlemire, sheep farmer, Brunswick, ME: Project design, trial evaluating body condition of ewes prior to and after breeding, information dissemination, evaluation of project results; Darel and Sally Smith, dairy farmers, Bradford, ME: Growth trial with dairy heifers.

Overview

The major costs to livestock operations in the northeast are the purchase, production and handling of feed. Grazing is the most economical form of feed acquisition on most farms. By growing and utilizing greater quantities of locally produced, high-quality forages, livestock production costs can be reduced without compromising productivity, thus increasing on-farm profit and sustainability. Brassicas can supply additional or supplemental forage, thus extending the grazing season in northern latitudes. When integrated into existing forage systems, Brassica crops have the potential to reduce: 1) the amount of purchased concentrates, 2) stored winter forage that needs to be produced or purchased, 3) harvesting costs and labor by allowing the animals to harvest the forage, and 4) costs and labor associated with manure disposal.

Tyfon, a Chinese cabbage-turnip hybrid, recently has gained considerable attention for use as a pasture crop in commercial livestock operations. To integrate Tyfon into existing forage systems in the northeast, farmers need additional information on the nutritional limitations of this crop and its effects on animal production and economic profitability. Reductions in herbicide inputs and soil erosion will also add to improved on-farm sustainability of northeast farms that can integrate Brassicas into their present forage system.
Progress Report 1991

To determine the economic feasibility of grazing Tyfon interseeded with perennial rye grass and the potential for reducing soil erosion.

A feeding trial using 30 spring lambs was conducted during the summer and fall months of 1990. Treatments consisted of: 1) a late spring seeding of Tyfon and perennial rye grass with summer and fall grazing, 2) a late summer seeding of Tyfon and perennial rye grass with a single fall grazing, and 3) a control group, where animals grazed a grass/legume pasture in the summer and were feed conserved hay from the pasture in the fall. When the lambs were not grazing the Tyfon/p. rye grass pasture, they were rotationally grazing the grass/legume pasture. Tyfon was seeded at a rate of 3.5 lb/A on June 22 and August 10. Perennial rye grass (Bastion) was seeded at the same time as the Tyfon at a rate of 15 lb/A. All 30 lambs began grazing the grass/legume pasture on May 22.

On August 24, the first flock, which was composed of twelve lambs, was allowed to graze the Tyfon/p. rye grass pasture seeded on June 22 (64 days after planting). Total herbage was 2.24 t/A (dm), 81% from Tyfon, 0.9% from p. rye grass, and 18.1% from weeds. After 40 days of grazing the twelve lambs were returned to the grass/legume pasture for 36 days. These twelve lambs were then returned to the Tyfon/p. rye grass pasture to graze the regrowth for an additional 25 days. Regrowth herbage yielded 0.85 t/A (dm), 96% from Tyfon, 0.8% from p. rye grass, and 3.0% from weeds. This system resulted in a grazing season of 195 days. Beginning on October 11, the second flock of lambs, which was composed of nine lambs, rotationally grazed the grass/legume pasture for 142 days and then were allowed to graze the Tyfon/p. rye grass seeded on August 10 (63 days after planting). The late summer seeded Tyfon/p. rye grass herbage was grazed for 36 days, resulting in a grazing season of 178 days. The pasture yielded 1.78 t/A (dm), 63% from Tyfon, 9% from rye grass, and 29% weeds. The last flock of lambs, which was composed of eight sheep, rotationally grazed the grass/legume pasture for a total of 178 days.

Animal weight and body condition scores were taken prior to and after grazing for all animals. Preliminary results showed
that the lambs that grazed the Tyfon/p. rye grass twice had higher average daily gain values followed by the lambs pastured on the single-grazed Tyfon/p. rye grass pasture and the grass/legume pasture. However, the gains were not statistically significant. The grazing season was significantly longer for those lambs that grazed the Tyfon/p. rye grass twice; nine out of twelve lambs achieved the target weight of 100 pounds with grazing. In the treatment which involved two grazings of the Tyfon/p. rye grass pasture, the forage provided 89.4 animal unit days per acre while the treatment which involves only one grazing of the Tyfon/p. rye grass provided only 37.9 animal unit days per acre.

For the 1990-1991 winter the early seeded Tyfon/p. rye grass pastures had 51.8% ground cover while the later seeded Tyfon/p. rye grass pasture had 74.5% ground cover. The difference was due to a better stand of perennial rye grass for the second seeding compared to the first seeding, 29% and 6.8%, respectively. Quality analysis of the forage and development of an economic budget are still in progress.

Objectives

(1) Determine the intake, digestibility, and subclinical health effects of a Tyfon-based ration as influenced by various levels of hay roughage.

(2) Determine the growth, feed efficiency, carcass quality traits, and subclinical health effects of lambs fed diets containing varying proportions of Tyfon and hay.

(3) Determine the consumer acceptance of milk from dairy cows fed Tyfon.

(4) Determine the potential of establishing Tyfon, via no-till, into pastures without herbicides and the N fertility requirement in this situation.

(5) Determine the economic feasibility of grazing Tyfon interseeded with perennial rye grass and the potential for reducing soil erosion.

Project Duration: One year

Funding: $85,000 in 1989. Matching, $148,957.

Organization	Sustainable Agri. Funds	Matching Funds
University of Maine	$50,180	$69,277
University of Connecticut	34,820	79,680
Totals	$85,000	$148,957

LNE89-13: WINTER COVER CROPS FOR CORN PRODUCTION IN THE NORTH-EAST: N BALANCE AND SOIL MOISTURE STATUS

(Revised 4/14/93)

Major Participants:

University of Maryland: A. Morris Decker (Project Coordinator), Forage Management, Agronomy Department, College Park, Maryland, MD 20742, Phone: (301) 405-1321. M.S. McIntosh, Statistics; B.R. James, Soil Chemistry; F.R. Mulford, Farm Manager; R.R. Weil, Soil Fertility; K.C. Conover, Beltsville Facility, Central Maryland R & E Center; A.J. Clark, technician; Wayne Shaff, Wicomico County extension agent.

USDA/Agricultural Research Service: J.J. Meisinger, Beltsville, MD.

Farmers: Robert Ellis, Salisbury, MD: Will evaluate crimson clover winter cover on twenty acres; Calvin Sherman, Salisbury, MD: Will evaluate crimson clover winter cover on nine acres; Norman Brittingham, Pittsville, MD: Will evaluate hairy vetch winter cover on twelve acres.

Overview

Winter annual legumes can provide most or all of the N required by no-tillage corn. Small grain covers can recycle more unused fertilizer nitrogen (FN) than legumes, thus reducing potential for leaching and groundwater contamination, but the high C:N ratio of cereals can lower N availability to subsequent crops. When spring rainfall is low, cover crops can deplete soil moisture and jeopardize corn germination and early growth. This project will evaluate the management of hairy vetch, cereal rye and vetch/rye mixtures in cover crop-corn systems in terms of cover N production, N recycling, groundwater quality and soil moisture in order to optimize profits without damage to the environment. Research plots will be established at Maryland Coastal Plain and Piedmont locations. Demonstrations on three commercial grain farms and two Experiment Station farms will include field-scale plantings of selected treatments from research plots. Field days and twilight meetings will be held at research locations and on-farm demonstration locations.

Objectives

(1) Extend field plot research findings to field-sized research/demonstration programs on commercial farms.

(2) Determine effects of kill dates of hairy vetch, cereal rye and vetch/rye mixtures, plus no-tillage corn planting dates on nitrogen status of soils and crops, soil moisture availability during germination and early growth, and shallow groundwater quality.

(3) Develop predictive models to identify viable management alternatives for cover crop use in corn production systems.

Results

Replicated small-plot studies were conducted over a two-year period at Coastal Plain and Piedmont locations to evaluate the effects of cover crop kill dates, corn plant dates, and corn fertilizer nitrogen (FN) rates following hairy vetch, cereal rye, and a vetch/rye mixture in a no-tillage corn production system. Research evaluated cover crop yield and N production, corn N uptake and yield, soil moisture use efficiency, and soil N status.

Results substantiate that vetch can fix most of the N required for high corn yields. When more N is required N responses are greater following vetch than following rye or no

cover. This synergistic response appears to be related to more efficient soil water utilization. Research has shown that fall-seeded rye will immobilize more soil N than vetch, thus, reducing the potential for winter nitrate leaching. Data from these studies support the thesis that vetch/rye mixtures can maximize N production, minimize the potential for N leaching, and enhance corn yields.

Cover crop kill dates and corn plant date are critical in terms of N fixation, N recycling, and soil moisture utilization. The ideal kill date will vary with location, soil, and annual climatic pattern but will usually fall between April 20 and May 10 and the best kill date should be what is best for the dominant species in the mixture.

Composition of a fall-seeded legume/grass mixture will adjust to the soil N status in that the grass will dominate when the residual N is high while the legume will dominate when the N level is low. This offers good environmental protection while reducing fertilizer N costs to the producer. Shallow ground water samples show lower nitrate concentrations under rye or vetch/rye mixtures, but more study is needed since data are noisy and may reflect previous cropping history.

Project Duration: One year

Funding: $105,000 in 1989. Matching, $142,748.

Organization	Sustainable Agri. Funds	Matching Funds
University of Maryland	$105,000	$142,748
Totals	$105,000	$142,748

LNE89-14: NORTHEASTERN ORGANIC AND SUSTAINABLE FARMER NETWORK: MANUAL OF CURRENT PRACTICES, EXTENSION TRAINING AND FIELD DAYS

(Revised 4/14/93)

Major Participants:

Cornell University: Judith J. Green (Project Coordinator), Extension Support Specialist, Farming Alternatives Project, 422 Warren Hall, Ithaca, NY 14853.

Natural Organic Farmers' Association: Edwin N. McGlew III, Dairy Farmer and Treasurer of the NOFA Interstate Council, 140 Chestnut Street, West Hatfield, MA 01088.

Miranda Smith: Writer/Consultant in Organic Agriculture, 63 LaFountain St., Burlington, VT 05401, will oversee the research, writing, review and publication of the manual of current practices in organic farming in the northeast region.

University of Massachusetts: Karen Idoine, Associate Extension Agent for Agriculture, 238 Main St., Greenfield, MA 01301 is coordinator (with Grace Gershuny) of Extension in-service training program. Grace Gershuny, GAIA Associates, Principal, Organic Farm Service, Box 84, RFD 3, St. Johnsbury, VT 05819.

State Extension Contacts: Latif Lighari, CT; Richard Brzozowski, ME; Karen Idoine, MA; Bruce Clement, NH; Clare S. Liptak, NJ; Martin N. Culik, NY; Stu Gibson, VT.

Farmer Participants:

Organic and Sustainable Farmers' Network, State Coordinators: The following organic farmers (listed alphabetically by state) will serve as coordinators of the farmer network and will help to develop criteria for selecting the master farmers, oversee their selection, organize and publicize the farm field days in their respective states. (A list of other participating farmers is available from the Project Coordinator.)

Connecticut: Alton Eliason, 214 Parsonage Hill, Northford, CT 06472.

Maine: David Colson, 470 Davis Road, Pownal, ME 04069.

Massachusetts: Maureen Blasco, Bittersweet Farm, 683 River Road, Winchendon, MA 01495.

New Hampshire: David Trumble, Old Country Road South, Francestown, NH 03043.

New Jersey: Al Johnson, RD #1, Box 263A, Pennington, NJ 08534.
New York: Elizabeth Henderson, Rose Valley Farm, Rose, NY 14542-0149.

Vermont: Will Stevens, Golden Russet Farm, RD #1, Box 94, Bridport, VT 05734.

Overview

There is no comprehensive source of information on organic farming and other low-input farming systems readily available to farmers, agricultural agents or researchers. This project was designed by a committee of the Natural Organic Farmers' Association (NOFA) Interstate Council to fill this substantial gap in information. This project will remedy this lack in three ways: 1) establish a network of experienced organic and sustainable farmers in the northeast states who will provide information for researchers, hold field days for other farmers and farm demonstrations for agricultural Extension Agents; 2) write, publish, and distribute a manual of current practices on farms using organic and sustainable methods; and

3) design and disseminate an in-service training program for Extension agents and other agricultural consultants on organic and sustainable farm production systems and management.

Objectives

(1) Create a network consisting of at least three organic and sustainable farmers in each northeast state and conduct a series of field days for farmers and farm demonstrations for extension agents at fifteen of these farms.

(2) Produce a manual documenting the production practices currently in use on certified organic farms in the northeast: Organic farming represents one end of a continuum from chemical-intensive to chemical independent agricultural systems.

(3) Expand the range of options which Cooperative Extension agents can suggest to the increasing numbers of conventional farmers who are inquiring about low-input systems, by training agents in the production, management and marketing issues involved in organic and sustainable agriculture.

Results

The project implemented both a set of concrete activities and a collaborative process aimed at increasing the mutual understanding and knowledgesharing between the organic farming community and the "conventional" agriculture community.

Three major activities were undertaken:

- On-farm field days were held on 21 farms throughout the Northeast during the summers of 1989 and 1990. The series featured producers of organic and low-input field crops, vegetables, tree fruits, dairy, beef, sheep and poultry, as well as on-farm composting operations. Nearly 1,000 farmers, extension personnel and other attended the series.

- Experienced farmers were identified and interviewed to provide documentation of the farming practices currently used by organic and low-input farmers in the Northeast. Specific production practices documented included crop orations, use of cover crops and green manures, composting, soil amendments, tillage and cultivation regimes, livestock health and nutrition, pest management strategies, and marketing practices. A draft publication, Organic and Low-Input Farming Systems in the Northeast, has been produced and reviewed. Arrangements for publication of the book are under negotiation.

- In-service training for Cooperative Extension agents and other agriculture professionals was offered in three states.

The process of organizing these activities brought together organic farmers, Extension agents and Land Grant specialists in a variety of context, and helped to clarify differences as well as similarities of perspectives, values and methodological approaches to the problems faced by farmers.

Project Duration: 1989-1991

Funding: $115,000 in 1989. Matching, $81,314.

Organization	Sustainable Agri. Funds	Matching Funds
Natural Organic Farmers' Association	$84,650	$60,054
Cornell University	30,350	21,260
Totals	$115,000	$81,314

LNE89-15: EGGPLANT: A MODEL SYSTEM FOR IMPLEMENTING THE INTEGRATION OF A BIOLOGICAL CONTROL INTENSIVE PEST MANAGEMENT FOR THE MAJOR INSECT AND DISEASE PESTS OF SOLANACEOUS CROPS IN THE NORTHEAST

Major Participants:

Rutgers University: James Lashomb (Project Coordinator), Cook College, Entomology, New Brunswick, NJ 08903; George Hamilton, Entomology, Extension; Steve Johnston, Plant Pathology, Extension and Research; Robin Brumfield, 100% Extension; Pritham Dhillon, Agricultural Economics and Marketing, Teaching and Research.

County Agents: Philip Nieri, Gloucester County; Peter Probasco, Salem County; Jack Rabin, Cumberland County.

USDA/Agricultural Research Service: Debbie Fravel, Research Plant Pathologist Biological Control of Plant Disease Laboratory.

New Jersey Dept. of Agriculture: William Metterhouse, Director of Plant Industry; Robert Chianese, Chief of Beneficial Insects Laboratory.

Farmer Participants:

New Jersey Vegetable Farmers: Sam Ballinder and Mullica Hill, Gloucester County; Daniel Deola, Robert Ferrari, and Donald Tarrabio, Vineland, Cumberland County; William Horner, Swedesboro, Gloucester County; William Lillya and John Musemeci, Woodstown, Salem County; Sam Walker, Porchtown, Salem County.

Overview

The Colorado potato beetle (*Leptinotarsa decemlineata (Say)*) and verticillium wilt (*Verticillium dahliae*) are profound pests of tomatoes, potatoes and eggplant in the northeast. The beetle is highly insecticide resistant. Colorado potato beetle was resistant to second and third generation pyrethroids before they were out of the research laboratory. Population growth is very explosive, often completely defoliating a crop before any economic returns are realized.

Many growers rely on the very expensive and environmentally hazardous soil sterilizing fumigants to control verticillium wilt. Rotation is used by potato and vegetable farmers with limited success, since the infective stage can remain viable in the soil for at least five years. Biological Control Intensive Pest Management (BCIPM) is a promising alternative for both problems: a parasitic wasp lays its eggs in the beetles' eggs, and verticillium wilt can be controlled by a soil antagonist.

Objectives

(1) Refine a BCIPM delivery system of a parasitic wasp (*Edovum puttleri*) for protecting eggplant yield against Colorado potato beetle populations.

(2) Demonstrate the benefits of a soil-borne antagonist (*Talaromyces flavus*) against verticillium wilt in eggplant as a model for wider use in potato.

(3) Determine the economic feasibility of using BCIPM for Colorado potato beetle and verticillium wilt in eggplant as a model system for further implementation in potato and tomato.

Project Duration: One Year

Funding: $25,000 in 1989. Matching, $145,650.

Organization	Sustainable Agri. Funds	Matching Funds
Rutgers	$25,000	$145,650
Totals	$25,000	$145,650

LNE89-16: EVALUATION OF ALTERNATIVE STRATEGIES FOR SMALL FRUIT PRODUCTION

(Revised 4/14/93)

Major Participants:

The Pennsylvania State University: Barbara L. Goulart (Project Coordinator), Dept. of Horticulture, 101 Tyson Building, University Park, PA 16802. Conducts research in genotype productivity evaluations, and post-harvest control of *Botrytis* on raspberries using a biologically derived substance; Edwin W. Rajotte, Dept. of Entomology, conducts research in bramble insect sensitivity and testing of biorational chemical controls of insects; James W. Travis, Dept. of Plant Pathology, conducts research in genotype disease resistance and disease management strategies; Robert D. Weaver, develops and implements survey characterizing small fruit producers' perspective on low-input practices.

Cornell University: Marvin Pritts, Pomology, 60% extension, 40% research, Dept. of Pomology, 134-A Plant Science Building, Ithaca, NY 14853, project coordinator for NY projects; Eric Nelson, pathologist, black root rot project; David Trinka, Pomology graduate student, establishment studies with raspberries; Mary Jo Kelly, Pomology technician working a majority of time on this project.

University of Maine: David Handley, small fruit specialist, 100% extension, Highmoor Farm, Box 179, Monmouth, ME 03824, conducts research on strawberry genotype sensitivity to tarnished plant bug and potential of rowcovers as insect barriers in cooperation with J. Pollard, University of New Hampshire; James L. Dill, extension pest management specialist, Pest Management Office, 491 College Avenue, Orono, ME 04473, evaluation of tarnished plant bug populations and behavior on strawberries.

University of Massachusetts: Dan Cooley, integrated pest management specialist, Dept. of Plant Pathology, Fernald Hall, Amherst, MA 01003, conducts research on biological control of *Botrytis* and black root rot; Sonia Schloemann, integrated pest management coordinator, Dept. of Plant Pathology, conducts research on two-spot mite control using predacious mites, soil solarization as a substitution for fumigation.

Extension: Wayne Wilcox, Plant Pathology, 70% extension, 30% research, Dept. of Plant Pathology, NYSAES, Geneva, NY 14456, cooperates on research on strawberry and bramble genotype/disease interactions, strawberry black root rot cultivar screen, raspberry trellising systems; Mark A. Castaldi, regional extension specialist, Hudson Valley Laboratory, P.O. Box 727, Highland, NY 12528, compares costs of establishment, operation, and relative profitability of small fruits grown under low-input regimes; Steve Hoying, extension fruit specialist, Alton, NY, interplanted cover crops, raspberry trellises; Warren Smith, extension fruit specialist, Hudson Valley Lab, Highland, NY, black root rot cultivar screen.

Appalachian Fruit Research Station: Wojciech Janisiewicz, research plant pathologist, 100% research, Rt 2, Box 45, Kearneysville, WV 25430. Control of *Botrytis* with pyrrolnitrin and antagonists; Fumiomi Takeda, research horticulturist, 100% research, conducts field and lab (room temperature) trials, respectively, using pyrrolnitrin, a biologically derived chemical control for strawberry and raspberry pathogen control.

International Process Systems: Lewis Naylor, vice president, ALLGro Distributor, Inc., Ithaca, NY, compost for control of black root rot.

Farmer Participants:

Growers: Robert Chase, small fruit grower, Chase Farms, Fairport, NY, interplanted cover crops, raspberry trellises; Roderick Dressel, strawberry grower, Dressel Orchards, New Paltz, NY, black root rot cultivar screen; Everett Hatch, fruit and vegetable grower, Greenfield, MA, IPM, mite predators and *Botrytis* biocontrol; John J. McCue, farm supervisor, Highmoor Farm, P.O. Box 179, Monmouth, ME 04259, oversees and maintains research plots at Highmoor Farm; Tim Nourse, nurseryman, grower, cooperating on predator mite and yeast control of *Botrytis* on strawberry; Dale Riggs, strawberry grower, RT 22, Box 149A, Stephentown, NY, interseeded cover crops; Erick Smith, strawberry grower, Brookton Hollow Farm, Brooktondale, NY, site for black root rot cultural practices study; Daniel Tanwzinski, fruit and vegetable grower, Great Barrington, MA, IPM, mite predators and *Botrytis* control; Maurice Tougas, fruit grower, Northboro, MA, IPM, mite predators and *Botrytis* control.

Overview

Five of the states in the Northeastern Region propose to continue research on a multidisciplinary project exploring the feasibility of production techniques for strawberries and brambles which could greatly reduce chemical pesticide and fertilizer inputs while maintaining profitability.

This project will study nearly all phases of strawberry and bramble production, from preplant preparation to postharvest disease control, evaluating new strategies to lower chemical pesticide applications, while maintaining a high-quality product. Specific experi-

mental objectives include: evaluation of non-chemical techniques of soil sterilization, weed control and ground cover management; screening of strawberry and raspberry germplasm for disease and insect susceptibility and productivity; evaluation of new planting and production practices designed to reduce pest pressure; and evaluation of biological agents for the control of postharvest fruit rots.

This study will be carried out by extension specialists, agents and research scientists from four universities, the United States Dept. of Agriculture, a private company, and small fruit growers. Information transfer is a priority, using such diverse means as a sustainable small fruit newsletter, grower experimental plots, the participation of growers in integrated pest management programs, the development of user-friendly software for grower implementation, as well as more traditional means of information dissemination such as grower meetings, trade journals and scientific publications. Much of this project will require field research (and funding) over several years, due to the perennial nature of the crops and climatic variations.

Objectives

(1) To devise and test production and pest management practices which will reduce the need for chemical pesticides and fertilizer.

(2) To transfer technological advances by demonstrating the feasibility, profitability and rationality of alternative practices to existing and potential small fruit growers.

(3) To evaluate the economic feasibility of newly developed sustainable practices.

Results to Date

During the last reporting period, the project has focused more on the critical phases of strawberry production, with less emphasis on red raspberry production. The research includes but is not limited to non-chemical techniques of soil sterilization and/or increased fertility, integrated pest management techniques for weed, insect and disease control, screening of strawberry germplasm for disease and insect susceptibility and productivity, characterization of a new system for red raspberry production, and the identification and evaluation of biological agents and agricultural composts for the control of post-harvest rots and black root rot.

If widely adopted, participants suggest, their findings would allow farmers to continue to produce a profitable crop while minimizing pesticide inputs. This is because emphasis would shift from chemical treatment after the pest symptoms are observed to preventative measures before problems occur. Tolerant cultivars, improved cultural system and biological control agents are part of this preventive IPM approach. The project has identified and tested many such practices that would not be expensive to implement. Chemical treatments would

still be available if preventive measures fail, but they would not be used as a first line of defense.

If rowcovers are widely adopted as a tool for strawberry production in the Northeast, yield increases of 25-50 percent could be realized, depending on the percentage of fields using this treatment and the varieties used. This would increase profits to farmers without requiring additional land or fertilizer inputs, and could reduce the amount of insecticide used presently for tarnished plant bug.

If tarnished plant bug resistance (as was found in this research with small plots) could be exploited in large single strawberry variety fields, growers could achieve significant reductions in insecticide inputs with little or no loss in profits. If resistance to tarnished plant bug is dependent on the presence of susceptible (preferred) varieties, then a system of trap crops could be developed which would allow farmers to reduce or eliminate insecticide use for this pest.

Project Duration: Four years, through 1993.

SARE funding: $521,768 1989-1992. Matching, $753,206.

Organization	Sustainable Agri. Funds	Matching Funds
Pennsylvania State University	$166,867	$176,648
Cornell University	116,678	267,716
University of Maine	64,239	94,459
University of Massachusetts	126,258	66,950
New Alchemy Institute	3,300	3,300
USDA/ARS	44,426	144,033
Totals	$521,768	$753,206

LNE89-17: IMPROVING MILK QUALITY AND ANIMAL HEALTH BY EFFICIENT PASTURE MANAGEMENT

(Revised 1/14/91)

Major Participants:

University of Vermont: J. Woodrow Pankey (Project Coordinator), Dept. of Animal Science, Mastitis Microbiology, Burlington, VT 05405.

Extension: John R. Kunkel, Veterinarian; Edward E.Wildman, Dairy Specialist.

New York State Mastitis Control Program: Philip Sears, Ithaca, NY, Director.

Cooperators:

Agri-Mark Milk Cooperative, Field Services: Yvon Lanoue obtains monthly milk quality data through coop quality testing labs and collects BTM samples for analysis by the Quality Milk Research Lab (QMRL), UVM, assists in economic evaluations based on the milk quality incentive program.

Vermont Dept. of Agriculture: Dan Scruton, Vermont Quality Milk Enhancement Program (VQMEP), assists in farm evaluation of milking management, collection of monthly BTM samples for analysis by UVM QMRL, economic evaluations and dissemination of results through VMQEP.

Farmer Participants:

Farmers: Vermont dairies and UVM herd.

Bovine practitioners: Steve Wadsworth, St. Albans; Joe Klopfenstein, Vergennes; Mark Catlin, Barre, monitors cooperator farms, conducts clinics, collects mastitis, reproduction and health data, retrieves DHIA data for monthly analysis; John Brigham, Brent Brigham and Austin Cleaves, dairy farmers, cooperators in VT LISA: record data for mastitis, reproduction, health and economics, provide producer insight into the project. Additional cooperator farmers will be obtained through veterinarians and coop field representatives.

Overview

Three grazing systems: intensively managed rotational grazing (IMRG), traditional continuous grazing (TCG), and confinement housing (CH), were compared on seventeen Vermont dairy farms to determine if grazing systems had an effect on milk quality, animal health and reproductive efficiency. Analysis of variance, using a general linear means

procedure, on monthly bulk tank milk samples for standard plate count were not significant at P,.05; however, differences indicated trends towards improved milk quality during the grazing season in pastured herds compared with confined herds. Mean standard plate count during May through October for IMRG herds and TCG herds (4.28 X 10^3 cfu/ml) and (4.97 X 10^3 cfu/ml) were lower compared with CH herds (12.67 X 10^3 cfu/ml).

Samples cultured on trypticase blood-esculin agar to determine total bacteria count and distribution of specific bacterial types and species, and somatic cell count (SCC) indicated differences during the grazing season towards lower mean counts of streptococci other than *Streptococcus agalactiae* in herds using IMPG (996 cfu/ml) compared with TCG and CH (2,242 and 1,416 cfu/ml). Mean CH (2.15 X 10^5 cells/ml) than either TCG or CH (2.15 X 10^5 cells/ml) during the grazing season.

Animal health and reproductive efficiency were evaluated by analyzing monthly reports by veterinarians incorporating barn records, DHIA test reports, and biweekly or monthly herd clinics. Mean occurrence of diseases, disease incidence densities, and estimates of risk were similar in all treatments for metabolic disorders, lameness and reproductive disorders. Udder disease, including clinical mastitis, udder edema, and teat injuries, were consistently less in herds managed on pasture compared with herds managed in confinement. When herds with fewer than 60 lactating cows were compared, incidence density of udder diseases was .09 cases/animal month in IMPG, .03 cases/animal month in TCG, and .16 cases/animal month in CH.

A LISA dairy seminar by participants informed the northeast dairy industry of project results. The seminar summarized results of grazing management on milk quality and animal health. Topics included monitoring of milk quality and herd health; incentive payments and milk pricing; summer forage feeding and protein quality in forage; and economics of grazing management. A highlight of the seminar was a small group discussion by participants expressing views on information they need for agriculture to be sustainable.

Objectives

(1) Compare economic effects of Voisin grazing, continuous grazing and confined housing systems on milk quality parameters.

(2) Determine incidence of mastitis in dairy cows managed under Voisin grazing and confined housing systems.

(3) Compare effects of Voisin grazing, continuous grazing and confinement on reproduction.

(4) Compare effects of these systems on animal health.

(5) Determine economic implications for farms when applying these systems.

(6) Disseminate results to the northeast dairy industry.

Project Duration: One year

Funding: $58,000 in 1989. Matching, $61,292.

Organization	Sustainable Agri. Funds	Matching Funds
University of Vermont	$53,000	$61,292
Cornell University	5,000	--
Totals	$58,000	$61,292

LNE89-18: MARKETABILITY OF LOW-INPUT AGRICULTURAL PRODUCE

(Revised 1/14/91)

Major Participants:

Rutgers: Clare S. Liptak (Project Coordinator), Rutgers Cooperative Extension Service, Somerset County Agricultural Agent, P.O. Box 3000, Somerville, NJ 08876; Dan B. Strombom, Rutgers Cooperative Extension of Cape May County, Agricultural Agent; Robert E. Wyse, NJ Agricultural Experiment Station, Senior Associate, Director, P.O. Box 231, New Brunswick, NJ 08903. Basil Englis, Marketing, Rutgers University, School of Business, New Brunswick, NJ 08903, consultant; Michael Gallo, Chief, Robert Wood Johnson Medical School, Division of Toxicology, New Brunswick, NJ 08903, consultant.

Cooperators:

Rutgers Cooperative Extension: Specialists: Donald J. Prostak, pest management; Steven Reiners, vegetable production; Joseph Fiola, small fruits; Robin Brumfield, farm management, Cook College, Rutgers University, P.O. Box 231, New Brunswick, NJ 08903.

New Jersey Dept. of Agriculture: John J. Repko, Director, Division of Markets, CN330, Trenton, NJ 08625.

Farmer Participants:

Farmers: Tom Everett, Ever-Lea Farms, 258 Beekman Lane, Somerville, NJ 08876; Bob Eurick, Mill Lane Farms, Mill Lane, Neshanic Station, NJ 08853; Peter Quick, Windward Farm, Whiton Road, Neshanic Station, NJ 08853; Matthew Fierst, Sunhaven Farms, 1018 Orchard Drive, Somerville, NJ 08876; Gary Mount, Terhune Orchards, 330 Cold Soil Road, Princeton, NJ 08540.

Overview

The question of marketability is of particular concern to farmers considering raising fresh produce in such programs as integrated pest management where attempts are made to reduce chemical inputs by substituting other techniques. There is considerable uncertainty as to how such produce might be marketed, specifically in pricing, advertising and promotions. This project will investigate the marketability of low-input fresh vegetable and fruit produce through a set of consumer surveys and market tests in New Jersey. The project team includes researchers, extension professionals and farmers.

Objectives

(1) Complete surveys to evaluate consumer perceptions and attitudes concerning fresh produce in regard to factors such as quality, local vs. non-local source, appearance and production methods.

(2) Combine attitudinal data with demographic data to identify market segments at which promotional and advertising efforts should be aimed.

Project Duration: One year

Funding: $20,000 in 1989. Matching, $36,175.

Organization	Sustainable Agri. Funds	Matching Funds
Rutgers	$20,000	$36,175
Totals	$20,000	$36,175

LNE89-19: REDUCED TILLAGE: ALTERNATIVE CROPPING SYSTEMS FOR VEGETABLE PRODUCTION IN THE NORTHEAST

(Revised 1/14/91)

Major Participants:

Cornell University: Robin R. Bellinder (Project Coordinator), research/extension, Dept. of Vegetable Crops, Ithaca, NY 14853. Weed Science, overall project coordinator, responsible for the weed control and tillage aspects of the projects in New York State, collaborator with the Michigan project.

Long Island Horticulture Research Lab: Darlene Wilcox-Lee, research/extension, Dept. of Vegetable Crops, 39 Sound Avenue, Riverhead, NY 11901. Coordinator of the Long Island projects and responsible for soil water aspects of all studies.

University of Connecticut: Richard Ashley, research/extension, Dept. of Plant Science, U-67, 1376 Storrs Road, Storrs, CT 06268. Coordinator of Connecticut projects, specialist with regard to the cultural management of the living mulch aspects of the studies.

Extension: Laura Pedersen, Cooperative Extension Agent, Ontario County, 480 N. Main St., Canandaigua, NY 14424. Ms. Pedersen has been a proponent of ridge-tillage for snap beans for number of years so when I approached her with this project she joined in willingly. Thanks to her efforts Mr. Wafler joined the team. She will be an active participant in all field days and extension activities.

New York State Agricultural Experiment Station: Curt Petzoldt, Assistant Director, IPM Program, Geneva, NY. Dr. Petzoldt has been interested in other reduced tillage work that has been done in the Vegetable Crops Weed Control Program and has acted as an adviser in the planning phase of the project. He will actively participate in the demonstrations (to be done in growers' fields in 1990 and 1991) and educational events.

USDA/Soil Conservation Service: Alan Connell, District Conservationist, Riverhead, NY. Will provide technical expertise in soil water measurement and the determination of soil erosion potential under various ground covers. In addition, he has provided valuable assistance in obtaining grower participation in this project.

Comstock Foods: Gerry Ivison, Field Manager, Bergen, NY. This is the company that processes Craig Yunker's organic vegetables for Earth's Best Baby Foods. Mr. Ivison's expertise with both growing and processing concerns will make him an excellent consultant. He is also providing us with the seed we need for the pea project.

Farmer Participants:

Lyle Wells, Riverhead, NY, member of the Board of Directors of the New York State Vegetable Growers Association. Mr. Wells has been particularly interested in producing no-till pumpkins and approached us with his interest. He has been invaluable in the early discussion phase of the project and will be a participant in the field trial phase.

Paul Wafler, Wolcott, NY. Mr. Wafler is one of the courageous few willing to experiment with the idea of reduced tillage vegetable production. He has participated in the early planning phases of the snap bean studies and has already planted wheat and hairy vetch mulches for this first trial in 1989.

Craig Yunker, CY Farms, Elba, NY. He has an interest in growing vegetables organically. He has grown both snap beans and peas for several years using organic methods. He will act as a consultant to our organic peas study and will grow two 14-acre plantings of peas in a plowed down alfalfa sod in 1991.

Overview

We are proposing to investigate the use of reduced and strip-tillage with interrow cover crops for vegetable production in the northeast. The research will be conducted at research facilities and growers' fields in upstate New York and on Long Island, and in Connecticut.

We will evaluate different grass and legume mulch/cover crop species for their ability to suppress weeds, conserve soil moisture and control soil erosion. Crop performance in each of the mulch systems will be determined and herbicide rates will be reduced utilizing the weed-suppressing potential of the mulches.

The studies will be conducted on a wide range of crops that are grown throughout the northeast and north central regions of the US. We will include tomatoes, cabbage or cauliflower, snap beans, sweet corn and pumpkins at multiple locations. The proposed research will help to define the specific requirements for reduced-tillage vegetable production that will be necessary if growers are to consider using such systems. Formulation of such recommendations in combination with the extension and education efforts involved in this project should provide commercial interest and participation in a system with both economic and environmental advantages.

Objectives

We are proposing to investigate the use of reduced and strip-tillage with interrow cover crops for vegetable production in the northeast. The specific objectives of the proposed work are:

(1) Evaluate potential cover crop/mulch species for their ability to suppress weeds, conserve moisture and reduce erosion. Growth characteristics like rate of growth, biomass production, degree of tillering and plant architecture will have a significant impact on the degree of weed suppression and soil and water conservation achieved. For example, the vertical architecture of the grass mulches may allow more water evaporation than the horizontal covers provided by legumes. Conversely, the potentially greater moisture under the legume mulch may enhance weed germination. Differences in light penetration in the two mulch types may result in changes in the species of weeds that germinate and develop.

(2) Determine the yield potential of numerous vegetable crops grown throughout the northeast when produced in strip or reduced tillage systems. Numerous problems have been reported when vegetables are grown in no-tillage systems. Three of the commonly reported problems are poor seed-soil contact or coverage; cold soils preventing germination; and reduced root development. We feel that the use of strip tillage, particularly coupled with the use of a chisel tine in the strip, will alleviate these problems. Our goal is not to obtain increased yields in these systems but to obtain yields equivalent to those currently produced with traditional plow/disc cultivation systems.

(3) Utilize the weed suppressing potential of a mulch to reduce rates of applied herbicides. In order to significantly reduce the chemical load on the environment we must convince large-scale commercial vegetable growers that herbicide use can be reduced without a reduction in yields (profits). Through a combination of physical and allelopathic characteristics some mulches prevent or suppress weed germination and/or growth. Delaying weed emergence by four to six weeks would eliminate the need for most soil-applied preemergence herbicides. Coupled with the currently labeled, highly selective post-emergence herbicides, growers can begin to apply herbicides at low dose on an as-needed basis as is done with insecticides and fungicides in traditional Integrated Pest Management Programs.

(4) Compare costs involved with each mulch/tillage/herbicide system. Each mulch used will require a different management approach; spring oats will winter-kill; hairy vetch will be mowed; and the remainder will require chemical regulation. It will be necessary to calculate all inputs into the system: man and machine time, fuel and chemical inputs, etc. It may prove that reducing the chemical inputs in dollars will be offset by increases in the other areas, however the benefit of reducing the chemical load on the environment and of reducing soil loss must also be factored into the economic equation.

Project Duration: Two years: 1991-1993

Funding: $10,000 in 1989; $37,300 in 1990. Matching, $108,327.

Organization	Sustainable Agri. Funds	Matching Funds
Cornell University	$31,965	$84,867
University of Connecticut	15,335	23,460
Totals	$47,300	$108,327

LNE90-20: WHOLE-FARM IMPACT OF CONVERTING CONVENTIONALLY MANAGED EASTERN VINEYARDS TO ORGANIC MANAGEMENT PRACTICES

(Revised 4/14/93)

Major Participants:

Cornell University: Chris M. Becker (Project Coordinator) and David M. Gadoury, Dept. of Plant Pathology, New York State Agricultural Experiment Station, Geneva, NY 14456, Phone: (315) 787-2367. They will design and implement all studies regarding development and management of grape diseases. Robert M. Pool, Dept. of Horticultural Sciences, will coordinate all studies on vineyard and vigor, yield and fruit quality as well as studies on soil fertility and moisture; Alan N. Lasko, Dept. of Horticultural Sciences, will design and implement all studies on vine water status and photosynthesis; Thomas Henick-Kling, Dept. of Food Science and Technology, will perform all laboratory quality assessments of fruit and fruit products and will coordinate sensory evaluation of fruit and fruit products; Timothy Dennehy, Dept. of Entomology, will design and implement all studies on management of grape insects and mites; Gerald White, Dept. of Agricultural Economics, Ithaca, will analyze production costs and revenues under conventional and organic management programs.

Roger Pearson, who died in March of 1993, coordinated this project from 1990 until his death. Pearson was a faculty member of the New York State Agricultural Experiment Station.

Cooperators:

Cornell University: George MacDonald, Dept. of Horticultural Sciences, New York State Agricultural Experiment Station, Geneva, will conduct the analyses of soil and petiole

samples for nutrients; Joseph Kovach and Timothy Weigle, Integrated Pest Management Program, will assist in educating growers on techniques and results of the study.

Cornell University Cooperative Extension Service: David Peterson and James Kamas, regional specialists for grapes, will use the trials for educational purposes by conducting field tours of the trials for growers and by explaining the results to them in newsletters.

Farmer Participants:

Vintner's International, Inc., Hammondsport, NY: Thomas Mitchell and William Dunn (vineyard manager and foreman, respectively) will manage the vineyards where the studies take place and will apply all needed treatments. Vintner's International operates a sophisticated computerized system to track all input of labor and materials and to record yields from each block.

Natural Organic Farmers' Association of New York, Inc. (NOFA): Scott Smith, Chairman of the Standards Committee and vineyard manager of Four Chimneys Farm Winery, an organic vineyard and winery operation in Himrod, NY, is consulting on the project as a source of information on acceptable organic vineyard practices.

Four Chimneys Farm Winery, Himrod, NY: Walter Pederson, owner, will also consult on the project as a source of information on acceptable organic vineyeard practices.

Overview

Because of increasing public concern over the use of pesticides in agriculture, growers in general are showing more interest in organic management practices. Eastern grape growers, confronted with loss of synthetic pesticides due to pest resistance and government and processor restrictions, are no exception. However, before a grower converts his entire operation to organic management practices, he needs to understand the consequences of this action in terms of pest problems, crop yield, produce quality and production costs and returns. We propose to determine pest populations and problems, vine vigor, yield, fruit composition, and juice and wine quality, as well as production costs in conventionally and organically managed vineyards. Vintner's International, Inc., one of the largest grower-winery operations in the eastern US, has committed 30 acres of vineyards and significant manpower to a five-year study of the conversion of conventionally managed vineyards to organic management practices.

Studies will be conducted in 10-acre blocks of the varieties Concord, Elvira and Seyval. In each 10-acre block, one half will be managed organically and the other half will be managed conventionally. Because grape is a perennial crop and the effects of conversion to organic practices may not be obvious in the first years of the study, observations must be made over several seasons. Therefore, conversion to organic practices will be initiated in

1990 and the study will continue for five years. Information from this study will have a substantial impact upon the development of organic viticulture in the northeastern United States. The systematic evaluation of organic management practices (a poorly researched area), and the comparison of these practices to conventional management, may provide a model for conversion of eastern vineyards if conventional management becomes unsustainable in the near future. The results of this study will be communicated to growers through field tours, meetings, and published reports.

Objectives

(1) Determine the impact of vineyard conversion on vine nutrition, soil fertility and moisture, vine vigor, capacity and yield.

(2) Determine the impact of vineyard conversion on disease incidence and severity.

(3) Compare the efficacy and survival of beneficial biological control fungi under conventional and organic management programs.

(4) Determine the contribution of dormant eradicant treatments to seasonal disease control under conventional and organic management programs.

(5) Demonstrate the efficacy of a non-pesticidal insect pheromone for control of grape berry moth; determine the long-term effects of eliminating conventional insecticides from vineyards; and develop risk assessment methods for management of grape leafhopper.

(6) Determine the impact of vineyard conversion on fruit and wine quality.

(7) Determine the impact of vineyard conversion on production costs and profitability.

(8) Relay results of the study to growers using current Cooperative Extension methods.

Results to Date

This section summarizes the third year's (1992) activities and responses.

Soil and petiole analyses indicate that conventionally and organically managed vineyards are similar in overall nutritional status. Differences in yield and yield components between the culture methods were less in 1992 than in previous years. The very wet growing season reduced the impact of any differential weed competition between the two systems. At the same statistical crop level, conventionally managed vines had higher soluble solids, which may indicate that the late season canopy of these vines was more functional.

Differences in competition and water use were seen when alternative cover crops were used between rows. The higher soluble solids at similar crop loads may indicate improved

canopy function when legumes are planted between rows. In-row weed management with propane weed burners appears to be as effective as paraquat, and in 1992 experience was gained using this method instead of paraquat to burn down grapevine suckers.

This was the first year of significant disease, due largely to the excessively wet growing season. Phomopsis was common in both Concord management systems, whereas downy mildew and black rot were severe in the organically-managed blocks. Powdery mildew and Botrytis bunch rot were common in both Seyval management systems, but powdery mildew was more severe on fruit of organically-managed vines. Diseases were not a problem in either management system of Elvira. The application of a biocontrol agent, Ampelomyces quisqualis, to an Aurore vineyard reduced the severity of powdery mildew and treatment with another biocontrol agent showed promise in controlling downy mildew.

Insect damage was less severe in 1992 due in part to unseasonably cool temperatures and rain. Grape berry moth damage exceeded the threshold in one portion of the organically-managed Concord vineyard. No conventional blocks received insecticide treatments. Foliar damage due to leafhopper was insignificant in all conventional and organic areas. Anagrus epos, an egg parasite of leafhoppers, was abundant and effective in preventing an estimated 80% of leafhopper eggs from hatching.

Concord grapes grown conventionally in 1992 were slightly riper in sugar and acid content than those farmed organically, yet there was no difference in juice color. There was no difference in the juice quality of Elvira grapes from either management system. Seyval grapes from the conventionally-farmed vines were also more mature with higher Ph and sugar content.

Growing costs, such as fertilization and mechanical weed control, for the organic vineyards were greater than for the conventional vineyards. Yield was higher for Concord and Seyval grapes grown conventionally, but lower for Elvira grapes. Nevertheless, returns to management, a measure of profitability, were greater for the conventional management system regardless of cultivar.

Because we are still in the early stages of this long term project, most extension efforts are limited to informing growers of the nature of the study. As individual components of the project, such as results from insect studies and ground cover management, come into fruition, growers are informed through publications and meetings.

Project Duration: Four years

SARE funding: 251,987 Matching, $236,071.

1993 SARE Grant Amount: $67,932 (funding to completion of project).
Non-federal matching funds:

Organization	1988-92 SARE Funds	Matching Funds
Cornell University	$251,987	$236,071
Totals	$251,987	$236,071

LNE90-21: HONEYBEE BREEDING FOR TRACHEAL MITE RESISTANCE IN THE NORTHEASTERN UNITED STATES

(Revised 1/14/91)

Major Participants:

The Pennsylvania State University: Bruce A. McPheron (Project Coordinator), Dept. of Entomology, 106 Patterson Building, University Park, PA 16802. Plans, oversees and analyzes all resistance experiments. Maryann Tomasko, project associate/apiculturist, Dept. of Entomology, plans and conducts resistance assays in Pennsylvania; supervises all mite infestation assays; organizes Pennsylvania workshops, distributes videotape.

Middlebury Community TV: Box 786, Middlebury, VT 05753. Provides video equipment and producers to make queen-rearing videotape.

Farmer Participants (Beekeepers):

Champlain Valley Queens: Kirk Webster, Commercial Beekeeper, Box 381, Middlebury, VT 05753. Establishes isolated mating yard, raises queens used in this project and conducts resistance assays in Vermont; prepares and teaches workshops, assists in production of queen-rearing videotape.

Commercial Beekeeper: Dennis Keeney, RD #1, Box 1089, Bethel, PA 19507. Provides 120 Pennsylvania colonies; rears control queens and queens from Pennsylvania colonies showing potential resistance for use in this experiment.

Overview

Apiculture is a traditional, classic example of low-input, sustainable agriculture. We have reaped the benefits of apiculture, $9.3 billion (1985 figures) in increased yield and quality of crops due to pollination by honey bees and over $100 million in annual honey production, with virtually no risk to consumers. Unfortunately, the recent introduction and spread of two parasitic mites has changed this scenario. Both the tracheal mite, *Acarapis woodi*, and the Varroa mite, *Varroa jacobsoni*, have had a severe negative impact on

apiculture throughout the northeastern US. Increased winter morality caused by tracheal mites has substantially reduced honey production and the number of colonies available for pollination service, particularly pollination of apples, blueberries and cranberries, all economically important crops in the northeast. This negative trend has not yet stabilized, suggesting that agricultural practices relying on honey bee pollination may be even more drastically affected in coming years. Application of menthol treatment currently provides some degree of control of these parasites. Efficacy of certain synthetic chemical pesticides is also under study for mite control. However, reliance on chemical mite control tactics adds a significant expense to beekeepers, may lead to resistance in the mite populations, and threatens the honey crop with direct exposure to pesticides.

We propose a cooperative project to evaluate levels of tracheal mite resistance in different honey bee genetic lines. Queens from northeastern apiaries that appear to have demonstrated some resistance to tracheal mite will be scientifically evaluated. Open-mated daughters of instrumentally inseminated queens available from commercial sources (also proposed to show resistance) will be evaluated under northeastern US conditions. Specific objectives include, but are not limited to, identifying and developing breeding stock resistant to tracheal mites, documenting the stability of this resistance under commercial conditions, and developing a simpler assay for tracheal mite resistance. Educational priorities include disseminating information on queen-rearing techniques to northeastern US commercial beekeepers. This multistate study is the first rigorously controlled fieldtest of tracheal mite resistance in honey bees.

Objective

(1) Explore the development of resistant stock as an alternative to chemical pesticides for control of honey bee tracheal mites.

Honey bee pollination is a classic example of low-input, sustainable agriculture yielding an enormous return. The annual value of pollination in just three crops, apples, blueberries and cranberries, is significant at the national level (Table LNE90-21:1). These three crops are also important in the northeastern US, with an annual value of more than $360 million. Apple production in this region has risen since 1970, and both cranberry and blueberry agreages have increased sharply since 1961. Unfortunately, apple growers in New York and Pennsylvania are experiencing difficulty in obtaining adequate numbers of honey bee colonies suitable for pollination. Small-acreage Maine blueberry growers who are unable to afford the high pollination fees paid by large growers face similar difficulties. These shortages are mainly due to the effects of two recently introduced parasitic mites, the honey bee tracheal mite *Acarapis woodi* and the Varroa mite, *Varroa jacobsoni*. Both mites are present in the northeastern US; while this proposal targets resistance to tracheal mites, field assay techniques developed should also apply to studies of Varroa mite resistance.

Table LNE90-21:1. Value of Honey Bee Pollination		
Fruit	National Annual Value ($ millions)	National Annual Value Attributed to Honey Bees ($ millions)
Apples	915.6	824.0
Blueberries	104.6	94.1
Cranberries	189.9	170.9

The most significant effect of tracheal mite infestation is a dramatic increase in winter colony mortality. Winter loss of 10% of the colonies per apiary (or less, in commercial operations) is considered normal. Pennsylvania beekeepers with confirmed tracheal mite infestation experienced average winter losses of 28.2% in 1989, and losses as severe as 80-90% have been documented in Pennsylvania, New York, Massachusetts and Vermont. In order to minimize losses, beekeepers are treating their colonies with menthol, which has been shown to reduce tracheal mite infestation levels. Other chemical insecticides, including amitraz, fluvalinate and cymiazole are currently being tested for effectiveness against tracheal mites. However, chemical treatments are expensive and time- and labor-intensive to administer. Increased costs of buying and applying chemical controls are passed on to growers of bee-pollinated crops in the form of increased pollination fees. These in turn are passed on to consumers.

Before the arrival of the tracheal mite in 1984, the average rental fee per colony paid to beekeepers for pollination was $16 for apples, $25 for blueberries, and $28 for cranberries. In 1989, the average price per colony for pollination of these crops was $21, $35 and $35, respectively. To further illustrate the magnitude of the problem, 21,000 colonies enter Maine for the purpose of pollinating blueberries each year. The increased cost to growers in 1989 for the pollination of blueberries was $210,000. This year, beekeepers and growers alike fear there will be a region-wide shortage of colonies for pollination at any price due to winter losses caused by tracheal and Varroa mites.

Breeding for mite resistance in honey bees represents a biological, rational alternative to chemical control methods. Chemical control of tracheal mites with menthol costs beekeepers approximately $2.00 per colony. In addition, the application is time-consuming and labor-intensive, interferes with honey harvesting and, in the northeast, is often ineffective. Further, other synthetic chemicals are not currently labeled for use on tracheal mite, may not be registered for some time, and are currently quite expensive ($10-$12 per colony) to apply. Even if such chemicals do become available, mites have a significant history of rapidly evolving resistance to acaricides. Moreover, putting pesticides in close proximity to honey destined for consumption may increase the public's exposure to pesticides.

Most beekeepers re-queen their colonies every one to two years. If the cultural practice of re-queening with resistant queens could be used in place of menthol or other chemical treatments to control tracheal mites, it would lead to a considerable savings in time, labor, and expense for beekeepers. By avoiding application of costly and potentially harmful chemicals, it would also maintain the availability of residue-free honey and an adequate supply of colonies for pollination at a reasonable price.

This project will explore the development of resistant stock as an alternative to chemical pesticides for control of honey bee tracheal mites using the following strategy.

a. Demonstrate the presence of resistance to tracheal mites in three different lines of promising honey bee stock.

Documentation of resistance in one or more honey bee lines is the requisite first step in implementing resistance as a region-wide mite control strategy. Researchers agree that observed variation among honey bee colonies should provide ample genetic material for a selection program to be successful. Once resistant stock have been identified, a continued selection and propagation program can be established by commercial queen breeders. Availability of resistant genotypes would lead to rapid adoption by beekeepers, since most beekeepers re-queen on an annual or biennial basis.

b. Test for the presence of resistance to tracheal mites in open-mated daughters of commercially developed resistant breeding stock.

Mite-resistant honey bee lines are available commercially. However, resistance has not been critically demonstrated. In addition, these lines are maintained by artificial insemination; queens produced in this manner are not suitable for introduction into producing colonies. If open-mated, daughters of these queens can economically produce hundreds of resistant daughters. These daughters could then be introduced into established colonies.

c. Determine the stability of resistance in stock produced by this project.

Commercial beekeepers generally re-queen annually or biennially. Honey bee colonies may, however, re-queen themselves for several different reasons. Prior work indicates that colonies headed by young queens suffer lower mite infestation levels, although genotypes of the young and old queens were not considered. Knowledge of the stability of mite resistance through time will permit beekeepers to optimize their re-queening schedule with respect to resistance.

d. Develop a new method of testing bees for tracheal mite resistance.

Commercial beekeepers currently lack an adequate method for quickly evaluating potential resistance in their stock. The present method of dissecting 50 bees per hive to count mites is too time-consuming and labor-intensive to be used in an efficient commercial

breeding program. Observation of infested colonies used in queen rearing indicate that population growth during the summer from initially small colonies could be a good indication of mite resistance. This method will be tested against other indicators of resistance, and, if proven to be an early indicator of resistance, the information will be made available to beekeepers through workshops and practical publications. Such a technique would permit commercial beekeepers and queen breeders to make efficient selections of their own resistant stock. A minimum of two field seasons will be required to adequately evaluate the use of nucleus colonies (nucs) as a tool to accelerate selection.

Project Duration: One year

Funding: $40,000 in 1990. Matching, $48,495.

Organization	Sustainable Agri. Funds	Matching Funds
Pennsylvania State University	$22,638	$37,300
Champlain Valley Queen Bees	17,362	11,195
Totals	$40,000	$48,495

LNE90-22: NOVEL ROTATION CROPS AS ALTERNATIVES TO FUMIGANT NEMATICIDE TREATMENT IN DECIDUOUS TREE FRUIT PRODUCTION

(Revised 4/14/93)

Major Participants:

Pennsylvania State University: John Halbrendt (Project Coordinator), Nematologist, Dept. of Plant Pathology, Fruit Research Laboratory, P.O. Box 309, University Drive, Biglerviell, PA 17307. He will coordinate overall project management as well as field plot establishment and nematode monitoring in Pennsylvania, will also conduct greenhouse assays to assess host suitability (nematode resistance) of the alternate crops and will evaluate crops for susceptibility to tomato ringspot virus. Bill Kleiner, Fruit Extension Specialist, will develop slide and video programs to communicate research results directly to growers and will integrate research findings into existing Expert Systems and IPM programs.

West Virginia University: Alan Collins, Agricultural Economist, Morgantown, WV, will be responsible for the economic analyses of alternate crops costs and benefits and will

evaluate the economic feasibility of integrating these crops with existing fruit production practices; James Kotcon, Nematologist, will serve as the principle West Virginia investigator and will coordinate field plot establishment and nematode monitoring in WV, will also conduct laboratory assays of biological control activity in soil microflora from these plots and will assess impacts on other nontarget organisms.

Farmer Participant:

Grower: Phil Roth, PAR Orchards, Fairfield, PA, will provide the Pennsylvania test site, provide on-site supervision and daily management of the plots, and will collaborate with project participants in project design and evaluation.

Overview

This project will continue the evaluation of the feasibility of seven (7) alternative rotation crops as substitutes for soil fumigants used to control dagger nematode (*Xiphinema* spp.) prior to replanting tree fruit orchards.

Replicated field plots will be established at orchard replant sites in Pennsylvania and West Virginia. Treatments will consist of plantings of canola, corn, fescue cultivars with and without an *Acremonium endophyte*, marigolds, oats, and wheat. Dagger nematode population densities will be determined at planting and periodically during two growing seasons to determine the effectiveness of these crops for suppression of nematode population densities. Soil sampling and laboratory assays will also assess the impacts of these crops on nontarget soil organisms such as earthworms, and nematode predators and parasites.

Greenhouse and laboratory experiments will be conducted to evaluate whether suppression is due to the host suitability of the crop or to the development of a soil microflora antagonistic to nematodes.

Economic analyses will determine the production costs, market potential and feasibility of integrating each of the alternate crops into existing production systems. Additionally, the costs and benefits to subsequently replanted orchard trees associated with nematode suppression will be estimated for each rotation crop and for soil fumigation.

This information will be incorporated into a slide and video program for growers and crop consultants. Findings will also be integrated into Expert Systems IPM programs and regional Extension publications to assure rapid dissemination.

Objectives

(1) Evaluate the effectiveness of seven (7) alternate crops for suppression of dagger nematodes in orchard replant sites.

Dagger nematodes, *Xiphinema americanum* and *Xiphinema rivesi*, are major risk factors associated with production of deciduous tree fruits in the northeast and throughout the United States. Other widely distributed nematodes of concern to fruit growers include root lesion nematodes, *Pratylenchus* spp.; ring nematodes, *Criconemella* spp.; and root knot

nematodes, *Meloidogyne* spp. All of these nematodes may cause serious yield losses when present in high numbers; however, because of the potential of dagger nematodes to serve as vectors of lethal virus diseases, nematode control strategies in fruit orchards are driven by the need to suppress dagger nematode population densities to the lowest possible level.

Current nematode control recommendations involve application of chemical nematicides and fumigants prior to replanting orchards. Two years of rotation crops are recommended to improve soil fertility and structure, control perennial weeds and eradicate other pests. The most frequently used rotation crops, corn and soybeans, help achieve these goals and provide an economic return to growers during the rotation years. However, both of these crops serve as excellent hosts for nematodes, increasing their population density, and thereby, increasing the need for chemical nematicide applications.

(2) Quantify the impact of alternate crops on dagger nematode reproduction, tomato ringspot virus transmission, soil microflora associated with nematode biocontrol, and other nontarget soil organisms.

To properly utilize rotation crops to suppress nematode populations, their mode of action must be understood. These crops may be nematode-resistant hosts or be toxic to nematodes. If so, their use as an orchard cover crop may be needed to extend nematode control throughout the life of the orchard.

A competing hypothesis suggests that these crops induce a soil microflora that contains naturally occurring nematode biocontrol agents. As such these cover crops could induce biological soil suppressiveness to provide a long residual effect after the orchard is established. Virtually no information is available to evaluate these phenomena; however, a new technique developed at West Virginia University has the potential to provide quantitative data to evaluate the significance of this mechanism.

Tomato ringspot virus, vectored by dagger nematodes, has a broad host range, thus alternate rotation crops should be evaluated for their virus host status. Crops that serve as virus reservoirs would be inadvisable for fruit orchard rotations.

Other soil organisms may also be impacted by these crops and have long term effects on the subsequent orchard crop. Specifically earthworm populations, known to be negatively affected by chemical nematicides, may also be impacted by nematode suppressive crops. Because of their importance in improving soil structure, earthworm populations provide an important bio-indicator of the impacts of rotation crops.

(3) Assess the economic implications of integrating alternate crop production into existing orchard practices.

The economic feasibility of producing alternate rotation crops within existing orchard operations is a key factor in their widespread acceptance and implementation. Additional

costs of crop rotation such as labor, machinery, and delays in fruit tree planting must be calculated against reduced pesticide costs and any returns from the rotation crop. For a complete economic analysis, efficacy of crop rotation versus fumigation must be incorporated into a yield loss function that assesses both reduced yields and increased tree mortality associated with nematodes.

(4) Disseminate research results via Extension and regional Extension Farm programs.

Five major horticultural stations are located within 50 miles of research sites and frequent interactions with Extension specialists will serve to maximize dissemination and utilization of our research. Regional and national dissemination occurs via meetings with the Northeast Nematology Research Project, the Cumberland-Shenandoah Fruit Workers Conference, the Stone Fruit Decline Workshop, and national professional society meetings. Growers and crop consultants in the region readily adopt new production recommendations, especially when economic benefits complement improved environmental protection. As such, relatively simple educational materials, e.g., slide shows and video programs, will reach a wide audience through existing extension programs. These materials will also enhance dissemination of findings nationwide.

Results

Researchers found that some crops may provide environmentally sound and economical tactics for controlling soil-borne disease that affect the tree fruit industry. Two rotation crops, marigold and canola, effectively suppressed dagger nematodes. Canola, a brassica species, was easier to establish, more successfully competed with weeds and seemed to be resistant to tomato ringspot virus.

Other brassica species have shown similar characteristics, but more research is needed to identify the best cultivars. No rotation was as effective as soil fumigation, although brassicas and marigolds were as effective after two years as post-plant nematicides in most experiments.

Some rotation crops - wheat, oats and fescue - gave inconclusive results, while others - sunflower, sudan grass and alfalfa - were good hosts for dagger nematodes.

Fruit growers have expressed interest in this work and researchers anticipate that an effective crop rotation program for dagger nematode control would be readily accepted.

Project Duration: One year and seven months

Funding: $28,000 in 1990; $30,745 in 1991. Matching, $55,003.

Organization	Sustainable Agri. Funds	Matching Funds
Pennsylvania State University	$31,064	$34,260
West Virginia University	27,681	20,743
Totals	$58,745	$55,003

LNE90-23: THE INTEGRATION OF CROP (POTATO) AND LIVESTOCK PRODUCTION SYSTEMS

(Revised 4/14/93)

Major Participants:

University of Maine: Barbara A. Barton (Project Coordinator), Dept. of Animal, Veterinary and Aquatic Sciences, Orono, ME 04469, Phone: (207) 581-2733. Alfred Bushway, Dept. of Food Science, 105 Holmes Hall, Phone: (207) 581-1625; Robert Hough, Extension Livestock Specialist, 338 Hitchner Hall, Phone: (207) 581-2789; Gregory Proter, Dept. of Plant, Soil and Environment Sciences, 114 Deering Hall, Phone: (207) 581-2943.

University of Maine Cooperative Extension: Leigh Morrow, Area Crops Specialist, Houltos Road, P.O. Box 727, Presque Isle, ME 04769, Phone: (207) 764-3361.

Penn State University: D.R. Buckmaster, Agricultural Engineer, Dept. of Agricultural Engineering, University Park, PA 16802, Phone: (814) 863-0734. Harold Harpster, Dept. of Dairy and Animal Science, 306 Henning Building, Phone: (814) 863-0734.

Overview

Potato farms in New England can be characterized as monoculture production systems with a limited degree of integration with livestock production systems in the surrounding communities. Monoculture systems typically have less flexibility to respond to market fluctuations and fewer options available to improve sustainability. Some of the forces faced by potato producers in Maine include: input costs related to fuel, fertilizer, herbicide and pesticide purchases; rigid product quality standards; production practices that frequently influence water and soil quality; soil erosion and depletion of soil organic matter; cull and by-product handling and disposal; and limited economic incentives to practice crop rotation schemes which would improve soil, water and crop quality. The ability of producers to deal

with these constraints is in part limited because potato farms are not integrated with other agricultural commodities, such as livestock.

A more sustainable infrastructure would result from the integration of livestock and potato production by strengthening the market opportunities for currently unprofitable small grain/forage rotations and potato by-products. Enhancing rotation viability will also result in decreased soil erosion and increased potato product quality. Feeding livestock potato and other by-products not only provides an environmentally sound and value-added method of disposal, but also allows unutilized nutrients in the form of manure to remain in the system as soil amendments.

Objectives

(1) Develop a management plan for using potato and other crop by-products and rotation crops as feedstuff for cattle including: a) the conversion of an uneven supply of cull potatoes into a steady supply of a consistent animal feedstuff; b) the study of the nutrient variability and quality of potato and other selected agricultural by-products as components of livestock diets and the development of strategies for their utilization; c) the design of systems so that cull potatoes and animal manure are not an environmental threat; d) the measurement of the characteristics of meat from animals fed potato culls and by-products as a major dietary component.

(2) Assessment of the economic, environmental and biological efficiency of this system.

Results

Project participants were successful in helping to create a more diverse agricultural system that would utilize potato by-products, break up disease cycles, reduce the need for pesticides, increase the quality of the potato crop and boost profitability for farmers. Project participants helped build the infrastructure to support a more profitable and sustainable beef industry in Aroostook County through educational programs, marketing initiatives and research activities.

Participants initiated an aggressive technology transfer program that included numerous educational activities for producers, obtaining and implementing low-cost designs for cattle-feeding facilities at several farms, and establishing a feeder cattle marketing system for Maine. Participants also worked with potato producers to shift rotation crops from oats to barley so that the grain could be used by cattle farmers in Maine. (Previously, potato producers in Aroostook County rotated primarily with oats, which were shipped out of state at relatively low prices, while cattle producers relied primarily on imported grain.)

The project also conducted a research study to determine the minimum amount of dry matter needed to ensile potato waste. The goal of this portion of the project was to reduce

feed costs for cattle growers, create a market for potato by-products and to reduce environmental problems associated with runoff from potato wastes.

Project participants consider the effort successful. Maine's beef industry has doubled since 1988, with most of the growth in the state's potato-growing region. Additionally, through marketing efforts, the value of the cattle inventory has more than doubled, with an increased return to the state's economy of over $11 million.

Project Duration: One year

Funding: $43,000 in 1990. Matching, $19,182.

Organization	Sustainable Agri. Funds	Matching Funds
University of Maine	$43,000	$19,182
Totals	$43,000	$19,182

LNE90-24: SUSTAINABLE SOD PRODUCTION FOR THE NORTHEAST

(Revised 1/4/91)

Major Participants:

University of Rhode Island: Richard A. Casgrande (Project Coordinator), Dept. of Plant Sciences, Kingston, RI 02881, Phone: (401) 792-2924. Serves as project coordinator and conducts direct insect research at URI, as well as coordinating insect research at the University of Massachusetts. W. Michael Sullivan, Agronomy, Dept. of Plant Sciences, will direct the agronomic aspects of this study, coordinating the work of URI field staff and local farmers, will also be responsible for the collection and analysis of samples for nutrient dynamics; Noel Jackson, Plant Pathology, Dept. of Plant Science, will assist Dr. Torello (see UM below) in laboratory work on endophyte transfers, and will monitor field plots of our blended sods for disease incidence; Dennis Wichelns, Resource Economics, Dept. of Resource Economics, will work with his graduate student to describe the economic implications of this system of sod production and compare it with traditional practices.

University of Massachusetts: William Torello, Agronomy, Dept. of Plant and Soil Science, will direct the insect work conducted at Amherst, MA and work on endophyte

transfers. He will also measure loline alkaloid levels in determining likely candidate grasses for insect resistance.

USDA Resource Conservation and Development Program: Bryan Wofenden, RI Coordinator, will serve in an advisory capacity in this project, ensuring that useful elements are incorporated into the project, and that useful information is disseminated to growers and the public.

Farmer Participants:

Albert Turf Farms: Susan Albert, Slocum, Rhode Island, a member of the New England Sod Producers Association, will donate sod for the demonstration experiments on sod maintenance in the landscape, and will participate in seeding and fertilization experiments in her fields.

South County Farms, Inc.: John and Myra Partyka, Heaton Orchard Road, West Kingston, RI, operate a diverse farm, marketing over 200 acres of sod annually. They will make several commercial plantings of new sod mixtures in their fields. Along with Ms. Albert, they will serve as a liaison between URI and commercial growers, facilitating information dissemination.

Overview

Turfgrass sod production is emerging as one of the few agricultural commodities that remain economically viable in Rhode Island and in urbanized areas of surrounding states. Presently, this sod consists almost entirely of Kentucky bluegrass, a crop that requires high inputs of fertilizer, water and pesticides for production and for maintenance in the landscape. Some sod growers are experimenting with new sod consisting primarily of tall fescue blended with bluegrass and other rhizomatous species needed to produce a harvestable sod. This shift in grass species is a response to consumer demands for sods with reduced maintenance requirements. Tall fescue is more tolerant of wear, low fertility, low moisture and shade conditions than most cultivars of Kentucky bluegrass. Many new commercially available varieties of tall fescue also contain an endophytic fungus which grows within the grass plant, further improving the plant's tolerance to many stresses, especially insects. Recent research indicates that some endophytic tall fescue cultivars might be resistant to all common insect pests of turfgrass, including the Japanese beetle.

This LISA project is intended to further the production and use of tall fescue and other low maintenance turfgrass sods. Specific research objectives address measuring the insect resistance of various mixtures of tall fescues and other grasses. Through another research objective, we are attempting to incorporate the endophyte-conferred resistance of tall fescue into other grasses which might also be useful in this project. Demonstration experiments are underway on the agronomic requirements for these new sod mixtures and we are working to describe the economic implications of this program of sod production vs. traditional bluegrass

culture. In another research component we are studying nutrient dynamics under sods produced and maintained with minimal inputs of water and fertilizer.

Research results will be published in scientific journals and presented through several Cooperative Extension channels including CES publications, grower meetings, and growers' field days. Demonstration plots will be planted, maintained and harvested by local commercial turf growers and will be toured during the annual turf field day and Sod Producers Field Days at URI (combined attendance over 1,000 from at least nine states).

We expect to meet most of the objectives of this proposal between 1990 and 1993. Clearly some aspects such as persistence in the landscape will require additional time, and some other components will likely continue past the grant termination. Most work will be conducted at the URI campus and in nearby commercial sod fields. Because the insect resistance research is central to determining turfgrass blends, this aspect was conducted at URI and at the University of Massachusetts at Amherst, MA during the 1990 season.

Objectives

(1) Insect resistance.

A great deal of effort has already gone into this aspect of the project, much of it in field evaluation of insect response to grasses and grass responses to insect feeding. Growth chamber studies are underway to refine our understanding of this relationship, as are laboratory studies to transfer endophytes between grasses.

Field evaluations.

As specified in our proposal last February, a series of plots was planted last spring with endophytic and non-endophytic plots of tall fescue, hard fescue, chewings fescue, and perennial rye grass. Bluegrass plots and mixtures of bluegrass with tall fescue rounded out the total of nineteen treatments, each replicated five times. The entire set of 90 plots was repeated at the University of Massachusetts at Amherst. Into these plots were placed screen cylinders, enclosing a 6-inch-diameter plug of grass plants, including soil and roots to a depth of eight inches. These cylinders were in turn inoculated with seven densities of Japanese beetle grubs, ranging from 0 to 24 grubs per cylinder. Following grub inoculation, plots were visually rated for damage every other week. In November most of these cylinders were disassembled, grubs were counted, and roots were measured. In Rhode Island, where the grubs are expected to successfully overwinter in these cylinders, the cylinders will be examined next season to monitor grass damage in the spring and early summer and to determine winter survival of the insects.

Analysis of this very large and complex data set will require some time and these results will not be available until at least the first of the new year. However, a cursory review of these data indicates that there may not be any impact of endophytes, grass species,

or grass varieties on Japanese beetle survival under the conditions of this experiment (near optimum growing conditions). An interesting observation was that grub densities measured in November tended to plateau around nine grubs per cylinder (45/sq.ft.), even when three times that many grubs were introduced. Perhaps intra-specific competition (cannabilism?, territoriality?) are important in limiting the upper densities of grubs that can be achieved.

A field survey of Japanese beetle grub densities in the 1987 Tall Fescue Variety Trial at URI tends to confirm these observations. Again, an incomplete analysis seems to indicate no relationship between endophyte content of the grass varieties and their associated grub densities. A very interesting observation made in these tall fescue plots was that there was no visable damage in any of the plots -- even those with very high grub densities. Several of these densities approached the plateau densities in our confined studies. Perhaps, due to the competition noted above, grub densities rarely reach levels damaging to tall fescue which, because of its relatively greater heat and drought tolerance, can outgrow grub damage -- even in midsummer.

At present we are measuring root and foliage samples from the cylinders and preparing to measure levels of loline alkaloids in these samples. All grubs collected in these samples have been saved to determine their size and weight. Data are being formatted for analysis. In the future we want to repeat aspects of this fieldtest under rain out conditions where moisture levels are carefully controlled. We hypothesize that under low moisture conditions, stressed plants will produce more loline alkaloids, perhaps impacting on Japanese beetle survival. Greenhouse experiments are now underway in which endophytic grasses are being grown under different moisture levels to measure the impact of moisture on loline alkaloid production. Results of these tests will determine the range of conditions for next summer's rain out trials.

In growth-chamber studies, first-stage Japanese beetle grubs confined on germinating tall fescue seedlings experienced seventeen times more mortality on endophytic (e+) grasses than on non-endophytic (e-) varieties of tall fescues. When similar larvae were confined on plugs of field-grown mature tall fescue in the growth chambers, there was no apparent difference in survival on e+ versus e- tall fescue. Experiments are underway to determine the nature of this apparent resistance in germinating seedlings and these will be expanded in the future to determine whether this resistance exists with larger beetle grubs and in other species of endophytic grasses.

Efforts to transfer *Acremonium coenophialum* into other grass species that do not normally contain this endophyte are progressing quite well. Endophyte from tall fescue has been introduced into callus tissue from red fescue and Kentucky bluegrass. To date, we have regenerated whole plants from inoculated callus tissue of Dawson red fescue and Pennlawn red fescue. When large enough, these red fescue plants will be examined for endophytic content. Kentucky bluegrass tissues remain in the callus stage, but by visual examination it appears that at least some are successfully inoculated. Alternative approaches for transferring endophytes are underway including embryo inoculations and inoculations of imbibed seed.

These latter approaches have resulted in some seedling plants on artificial media in petri dishes which will be transferred to the greenhouse and then examined for endophyte content. Other species of *Acremonium* are presently being isolated and cultured for additional transfer work.

As these sythetic endophytic cultivars mature, plants will be divided and increased in the greenhouse. Loline alkaloid levels will be measured in the roots of these plants and compared to naturally endophytic tall fescue under different levels of drought stress. Any plants that seem to offer potential for insect control will be further propagated and moved to the field for evaluation.

(2) Agronomic requirements.

Work on this objective is well underway, although slowed by the lack of available alternative sods. In 1989, there were two plantings: one at URI and one commercial planting of tall fescue mixed with bluegrass. In 1990, we made additional plantings at URI and 4 commercial growers also planted alternative sod mixtures.

Grass mixtures.

In URI plots we are evaluating plots of tall fescue mixed with 2%, 5%, and 10% Kentucky bluegrass, concentrating upon the 5% mixtures which we think will be ideal. Cooperating LISA grower Sue Albert has two fields of 95.5% (tall fescue, bluegrass) and other fields planted to various blends of bluegrass mixed with endophytic perennial rye grass and fine fescues. Another LISA cooperator, John Partyka, has planted a 12-acre experimental field using two cultivars of highly endophytic tall fescue and five varieties of Kentucky bluegrass. These seven grasses are planted in various combinations at various seeding rates. Two other local growers have planted tall fescue sods (one with netting to hold it together) and two are also experimenting with other mixtures of fine fescue and Kentucky bluegrass in their sods. All are sharing results with URI, but it is too early to draw many conclusions for these plantings, most of which are only a few months old.

Seeding technique is one aspect on which we already have considerable data from last season's work. It appears that because of segregation of the very different-sized seeds in the planter, it will be necessary to double-seed fields of tall fescue mixed with bluegrass. In fields that were planted first with one grass and then with the other, we find a uniform stand of mixed grasses. When seeds are mixed before planting, we do not find a uniform stand. It appears that 6-8 lbs. of seed per 1,000 square feed will be adequate for most turf-type tall fescues, but perhaps with the finest-leaved varieties 10 lbs. will be better. Seeding rate will get additional study next season.

Fertilization and irrigation.

Results to date indicate that fertilizer required for producing tall fescue sod will be in the range of 3-5 lbs. Nitrogen per 1,000 sq. ft. per year (130-220 lbs./acre) -- somewhat less than Kentucky bluegrass sod. It appears that after establishment, no irrigation will normally be necessary to produce this sod which will result in a considerable savings over bluegrass sod. The relationship between fertilization, irrigation, and time to maturity is still under evaluation. Very early data indicate that 14-16 months will be required to grow harvestable tall fescue sod -- about the same time required to grow Kentucky bluegrass to maturity. (Some growers have pushed bluegrass sods with high fertilizer rates and harvested in twelve months or less, but the economics and environmental consequences of this are questionable.)

(3) Nutrient dynamics.

The tall fescue sod under investigation and the other mixtures under consideration all require less water and fertilizer than conventional bluegrass sod. Work done to date at URI indicates that there is little or no loss of nitrogen to groundwater unless turf is overwatered and overfertilized and even bluegrass sod should not result in any groundwater contamination. We have instrumented plots of all the common cool season turfgrasses to measure nutrient dynamics. Preliminary data indicate that tall fescue is more efficient at capturing nutrients than bluegrass.

(4) Sod persistence.

Work toward this objective was necessarily delayed until the tall fescue/bluegrass sods matured enough for transplant. In November, we harvested the first of these sods from LISA cooperator Sue Albert. We sodded three athletic fields in a demonstration experiment, and we have transplanted some of the sod to URI to begin the fertilization/irrigation/wear experiments described in the grant proposal. We also anticipate another demonstration experiment next spring where we shall transplant more of this sod into a URI horticultural display garden and compare its performance to traditional bluegrass sod and some other alternative endophytic grass mixtures under a moderate wear, low maintenance regimen.

(5) Economics.

Last fall a URI graduate student in Resource Economics was assigned to the Sustainable Sod project to study the economic aspects of this program. At present, economic information is being gathered to establish a framework for evaluating the potential economic implications of producing alternative sod crops. A survey of economic literature is underway to locate recent articles on production and marketing implications of turfgrass sod. Specialists at state experiment stations in the northeast are being contacted to locate reports describing the farm-level economics of turfgrass sod production. Information gathered in these efforts will be used to develop baseline crop budget data for sod production. This budget will be

modified later to describe the potential economic implications of growing the alternative sods under investigation.

From the limited experience of researchers and commercial growers of tall fescue sod in Rhode Island, it appears that relative to Kentucky bluegrass, this crop will be more expensive to seed, but cheaper to water and fertilize. Because end users will not need to irrigate tall fescue sod after establishment, they may save the cost of installing and using an irrigation system. If this tall fescue sod is endophytic, users will likely also experience a savings in pest control. The net result of these factors is that users may be willing to pay a premium for this sod. These aspects, among others, will be evaluated over the next several months and will require continued close cooperation among the academicians, farmers and landscapers under this LISA project.

Project Duration: Two years

Funding: $80,000 in 1990; $81,848 in 1991. Matching, $164,340.

Organization	Sustainable Agri. Funds	Matching Funds
University of Rhode Island	$161,848	$164,340
Totals	$161,848	$164,340

LNE90-25[2]: IMPROVING CROP ADAPTATION TO ALTERNATIVE SYSTEMS

(Revised 3/6/91)

Major Participants:

Cornell University: T.C. Barker, senior research associate, Dept. of Plant Breeding and Biometry, 252 Emerson Hall, Ithaca, NY 14853, Phone: (607) 255-2180. Corn breeder/cropping systems agronomist with 100% research appointment on low-input sustainable agriculture program, responsible for cropping systems design, on-station and on-farm field trial implementation, and data collection for major agronomic traits at Aurora, Canton and Chazy, and will supervise the technician who will support field and on-farm activities at all locations; W.D. Pardee, Dept. of Plant Breeding and Biometry, department extension leader with 85% extension and 15% teaching

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[2] This LISA project has now become an ACE project -- **ANE91-1: IMPROVING CROP ADAPTATION TO ALTERNATIVE SYSTEMS**.

appointment, responsible for design and implementation of extension goals, and for coordination with collaborating extension personnel; Margaret E. Smith, Dept. of Plant Breeding and Biometry, corn breeder with 75% research and 25% teaching appointment, responsible for overall project coordination and design of breeding methodology.

USDA/SCS: M. van der Gritten, Manager, Plant Materials Center, Big Flats, NY (Box 360A, RD #1, Rt 352, Corning, NY 14930). Soil scientist with 100% research management appointment, responsible for implementation of field trials and data collection at Big Flats; will also facilitate extension efforts through the SCS.

USDA/ARS: R.W. Zobel, research geneticist, USDA/ARS and Dept. of Plant Breeding and Biometry, Cornell University, 1023 Bradfield Hall, Ithaca, NY 14853. Rhizobotanist with 100% research appointment, responsible for design and implementation of root research across cropping systems and for facilitating collaboration with ongoing Cornell Agronomy Department LISA project.

Overview

We propose to: 1) identify existing corn hybrids which are better adapted to specific LISA practices, and provide this information immediately to farmers and extension personnel; 2) identify those traits which must be improved to better adapt corn to LISA conditions; 3) initiate a corn breeding program to adapt cultivars to existing and proposed LISA procedures to enhance productivity and stimulate adoption of LISA systems; and 4) work with farmers, extension agents and seed companies to improve availability of hybrids adapted to LISA systems and farmers' ability to choose appropriate hybrids.

To accomplish these objectives, research will be conducted on experiment stations at four locations (Aurora, Big Flats, Canton, and West Chazy), and extended to on-farm trials near these stations during the second and following years. Four cropping systems, established on-station in summer 1989, will be studied: 1) a conventional management system similar to that used in current corn breeding and production fields, with full tillage and nitrogen inputs, 2) a no-till system with zero tillage and full nitrogen inputs, 3) a low-nitrogen system will full tillage but only a minimal starter nitrogen application, and 4) an interseeded system with full tillage, starter nitrogen application, and medium red clover sown between rows at lay-by.

On-farm trials will be established in summer 1992 to compare two or more contrasting corn hybrids on two or more alternative management schemes. With a minimum of two on-farm sites near each of the experiment stations, we will obtain a substantial amount of data to indicate the effect of varying management and environments (soil types, moisture regimes, soil fertility, etc.) on cultivar and system performance. In addition, these on-farm trials would facilitate effective extension of results. Work with seed companies will focus on identification of current hybrids with good adaption to LISA systems and commercialization

of new cultivars developed. Educational programs for extension agents and farmers will enable them to select better hybrids to fit their LISA systems.

Objectives

Work will be initiated to address the following objectives during year one of the project. Their completion will require continuing support for the five-year duration proposed for this work; however, initial results and products which would be expected after year one have been noted for each of the objectives.

(1) Identify existing corn hybrids which are better adapted to specific LISA practices than most, and provide this information immediately to farmers and extension personnel.

Results of an initial year's evaluation of corn hybrids in four cropping systems (conventional, no-till, low nitrogen, and red clover interseeding) will be available from trials grown at four locations, representing the range of environments from northern Pennsylvania to New England.

Highlights of First-Year Results

a. Medium-maturity hybrids under four cropping systems.

A group of varieties was evaluated at two locations (Aurora and Big Flats, NY) under four cropping systems (conventional, no-till, low nitrogen, and red clover interseeding). Results of the medium-maturity hybrid evaluations indicate that the cropping systems chosen for study represent different environments, as evidenced by the significant differences attributable to cropping systems for numerous variables. Differences appear to be more clearly established at Big Flats than at Aurora. In addition, significant system by variety interactions for days-to-flower at Aurora and for percent-stalk-lodging at Big Flats indicate that all varieties do not respond the same way to these differing cropping systems. Similar patterns for grain yield data suggest that with better established treatment effects, significant interactions would become apparent for this variable as well.

These interactions strongly suggest that 1) available varieties differ in their adaptation to LISA systems, and 2) there is genetic variation for adaptation to these systems which could be exploited via plant breeding. Finally, differences in the significance of variables and the performance of specific varieties at Aurora and Big Flats suggest that location effect may be quite important to evaluating performance under LISA systems.

b. Early-maturity hybrids under four cropping systems.

A group of early-maturing varieties was evaluated at two locations (Chazy and Canton, NY) under four cropping systems (conventional, no-till, low nitrogen, and red clover interseeding). The early-maturity hybrid evaluation demonstrated more significant cropping

system effects than the medium-maturity evaluation, suggesting that the differences between systems may become more pronounced under short season conditions. Significant system by variety interactions were also more prevalent than in the medium-maturity evaluation, but in any case confirm the conclusions from that study as relevant to this group of early-maturity varieties as well (i.e., available varieties differ in their adaptation to LISA systems, and there is genetic variation for adaptation to these systems which could be exploited via plant breeding).

c. Commercial hybrid evaluations on farms.

Large numbers of commercially available hybrids were evaluated in farmers' fields, under the LISA practices those farmers are currently using. These evaluations included only one system on a given farm. Each variety was grown in a two-row plot (5m long, 75cm between rows), with three replications planted per farm in a rectangular lattice design. Maturity classifications and numbers of hybrids tested, location of the tests, and nature of the LISA practice(s) being used on the farms were as follows:

Maturity Classification	# of Hybrids Tested	Location	LISA Practice(s) Used On The Field
Early	90	Cattaraugus	manure fertilization + rotation
Early	90	Ogdensburg	manure fertilization + rotation
Medium-early	81	Cortland	starter nitrogen only
Medium	56	Auburn	chisel plow
Medium	56	Big Flats	chicken manure fertilization

Identical trials were planted on conventionally managed farms, including early-maturity hybrids at Chazy and Fabius; medium-early-maturity hybrids at Lansing, Trumansburg, Knowlesville and Hall; and medium-maturity hybrids at Chemung and Mt. Morris. Data were collected in all trials on final plant stand, stalk and root lodging, percent grain moisture and field weight. Percent stalk and root lodging and grain yield are being calculated. Analysis of this data is still underway. Results will be published in the annual Cornell Corn Report and will ultimately be incorporated into the recommendations published annually in Cornell Recommends for Field Crops.

(2) Identify those traits which must be improved to better adapt corn to LISA conditions.

Data on plant characteristics (vigor, light interception, canopy structure, tissue nutrient levels, root parameters, maturity, stalk quality, yield) and cropping system characteristics (soil nutrient levels, week populations and biomass) will be analyzed in relation to performance in the four cropping systems mentioned above. This will provide preliminary indications of the traits conditioning better adoption to LISA systems.

In the medium-maturity and early-maturity variety trials conducted under four cropping systems described above, data on numerous plan characteristics were collected in order to determine which plan traits are associated with superior performance under LISA systems. Correlations with yield and subsequent regression analyses have been used to determine which traits are most closely associated with productivity. Analysis of the Aurora variety trial data indicated that number of plants emerged, chlorophyll reading at the 5-leaf stage, female flowering date, and final plan stand all showed significant correlations with grain yield. For the variety trial at Big Flats, number of plants emerged, chlorophyll reading at flowering, plant height, and final plant stand all showed significant correlation with yield.

These results are encouraging in that plant emergence and stand establishment are simply measured traits for which variation among existing varieties was clearly documented in both the medium- and early-maturity variety trials. Hence they should be very susceptible to improvement by plant breeding. The relationship between chlorophyll readings and yield at both locations is encouraging as well, given that this measurement is fairly easily done, particularly relative to other measurements which might be considered in evaluating nitrogen use efficiency.

(3) Initiate a corn breeding program to adapt cultivars to existing and proposed LISA procedures to enhance productivity and stimulate adoption of LISA systems.

One year of selection will be completed for the four cropping systems mentioned above, thus improving the adaptation of breeding populations to each of these systems. The improved versions of these breeding populations will provide the basis for both further selection and improvement in subsequent years, and open pollinated variety development directly from the selected materials. Significant improvement in adaptation requires such years of selection, and clearly improved products will be available only after that time.

A second cycle of divergent selection was performed on the four populations under improvement (Old Reid, New Reid, Old Lancaster, New Lancaster) for each of the four cropping systems (conventional, no-till, interseeding, low nitrogen). Twenty-one families from each population were evaluated in each cropping system in a single row plot (five meters long) with two replications at each of two locations (Aurora and Big Flats, NY). From each population, the seven best families from each cropping system were identified and sent to the Florida winter nursery for recombination among families selected from each population-cropping system combination.

We are pleased with the selection environments, since the same field strips of each cropping system are being used as were used in the medium-maturity variety by cropping system evaluation trials (described in section one above), and those trials provided ample evidence that the cropping systems chosen are different corn growing environments. Hence if there are genetically controlled traits for enhanced adaptation to these systems within our populations, we should certainly see improved adaptation to specific systems as a consequence of our selection efforts. At least three more cycles of selection will be needed before we can truly evaluate the potential for improving varietal adaptation to these cropping systems and analyze the resulting economic benefits. This information will be critically important to plant breeders and seed companies in determining how they will address variety needs for LISA systems.

(4) Work with farmers, extension agents, and seed companies to improve availability of hybrids adapted to LISA systems and farmers' ability to choose appropriate hybrids.

The project activities will be demonstrated at a minimum of three field days during year one. Discussion with extension agents and seed companies concerning the initial activities and results of this work will occur at various times during the year. In addition, at least three presentations to scientific audiences will be made.

Numerous extension activities were carried out in this first few months of the project. These activities were focused not only on farmers and researchers, but also on seedsmen who will be the most immediate clients for some aspects of this work. A list of extension activities follows.

a. Field days where this project was discussed:

Cornell Soils, Crops and Atmospheric Sciences Department field day at the Aurora Research Farm, 13 July 1990.

New York Agronomists and Resource Conservationists field tour at the Plant Materials Center, Big Flats, NY, 18 July 1990.

Soil and Water Conservation Society -- New Hampshire, New York, Pennsylvania and Vermont Chapters' field tour at the Plant Materials Center, Big Flats, NY, 19-20 July 1990.

Soil Conservation Society Area 1 Personnel field tour at the Plant Materials Center, Big Flats, NY, 24 July 1990.

Agronomists, seed producers and plant breeders from Pioneer Hi-bred Seeds, Inc., field tour at the Aurora Research Farm, 23 August 1990.

Soil Conservation Society Area 2 Personnel field tour at the Plant Materials Center, Big Flats, NY, 6 September 1990.

Soil Conservation Society Northeast and Midwest Plant Materials Meeting field tour at the Plant Materials Center, Big Flats, NY, 26-29 November 1990.

b. Seminars and other formal presentations about this project:

"Corn Adaption to Alternative Cropping Systems: A New Cornell Initiative" presented at the National Sustainable Agriculture and Natural Resources Conference, Lincoln, NE, 15-18 August 1990.

"Breeding Corn for Alternative Production Systems" -- presented as part of the Cornell Plant Breeding Department Seminar Series, 13 November 1990.

c. Publications discussing this research:

M.E. Smith, W.R. Coffman and T.C. Barker, "Environmental effects on selection under high and low-input conditions," in Genotype-by- Environment Interaction and Plant Breeding, ed. M.S. Kang (Baton Rouge, LA: Louisiana State University, 1990), pp. 261-270.

M.E. Smith and R.W. Zobel, "Plant genetic interactions in alternative cropping systems: Considerations for breeding methods," in Proc. Symp. Plant Breeding and Sustainable Agriculture: Considerations for Objectives and Methods, eds. D. Sleper, T. Barker and P. Bramel-Cox (ASA/CSSA, in press).

T.C. Barker and M.E. Smith, "Corn adaptation to alternative cropping systems: A new Cornell initiative," in Proc. National Sustainable Agriculture and Natural Resources Conference, eds. C.A. Francis, J.L. Bushnell and R. Fleming (Lincoln, NE, 15-18 August 1990), pp. 1-2.

Project Duration: One year

Funding: $60,000 in 1990. Matching, $93,111.

Organization	Sustainable Agri. Funds	Matching Funds
Cornell University	$50,250	$83,616
USDA/SCS	9,750	9,495
Totals	$60,000	$93,111

LNE90-26[3]: ALTERNATIVE STRATEGIES FOR CRANBERRY PRODUCTION IN THE NORTHEAST

(Revised 1/14/91)

Major Participants:

University of Massachusetts, East Wareham, MA 02538: Anne L. Averill (Project Coordinator), Dept. of Entomology, entomology, biology and management of small fruit insects, Cranberry Experiment Station. Responsible for project oversight and budget, compilation of progress report, and compliance with all University, state and federal regulations. With the full-time research technician, she will coordinate 1) meetings among major participants; 2) information dissemination; and 3) all research and demonstration activity conducted by various participants on project bogs. In addition, she will serve as project expert on insect identification and management and coordinate work related to insect management strategies.

Frank L. Caruso, Extension Plant Pathologist, cranberry diseases and their control, project expert on diagnosis of existing disease problems on the experimental sites, will design and coordinate on-farm experiments for the control of the disease(s) of economic importance at that site, comparing disease control with chemical fungicides to that using biological control measures, in particular, microbial fungicides. Will participate in the design of on-farm experiments to compare weed control by herbicide versus control by population-enhanced, naturally occurring weed-attacking microbial species (or a combination of both). Will evaluate on-farm experiments and choose the most effective treatments to use on integrated low-input demonstration site. Coordinates biological control experiments for fruit rot on varietal trials.

Carolyn J. DeMoranville, cranberry specialist, plant nutrition and fertility, project expert on cranberry nutrition. She will coordinate all fertilizer use for the low-input

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[3] This LISA project has now become an ACE project -- **ANE91-2: IMPLEMENTING AND EXTENDING LOW-INPUT CRANBERRY PRODUCTION.**

experimental bogs and tissue analyses. Will monitor productivity on experimental bogs and water quality, as well as design and implement on-farm experiments to fieldtest fish hydrolysate fertilizers developed during the project.

Karl H. Deubert, chemistry, project expert on water chemistry. He will coordinate water quality monitoring for low-input and traditional bogs. In addition, he will perform pesticide residue analyses on water samples collected during the project and develop timetable for sample collection. Also, will act as consultant on leaching rate studies of fish hydrolysate fertilizers.

Susan Edwards, research technician, 100%, will interact with all major participants and, under their directive, coordinate field work by implementing low-input bogs and experimental plots. Will collect, sort and analyze materials. Will communicate all aspects of the project to growers in Massachusetts and New Jersey, and produce a newsletter and other printed materials.

David Nolte, departmental assistant in Plant Pathology, 60%, will perform fieldtests for berry rot biocontrol, mycoherbicides experiments, spore trapping and the analysis of the spore trap data collection.

University of Massachusetts, Amherst, MA 01003: Mary Jane Else, IPM Weed Specialist, Dept. of Plant and Soil Sciences. Project expert in weed identification and management, cooperator for mycoherbicide studies and development of timing of pre-emergence herbicides and studies of herbicide reduction/elimination.

Pavince Chinachoti, Dept. of Food Science, Food Processing, will develop and evaluate methods (ultrafiltration and evaporation) for concentrating fish hydrolysate fertilizer to improve cost effectiveness. Will evaluate protein hydrolysis methods to find which produces the appropriate molecular weight profile for ultrafiltration. Will determine proper amount and timing for acid addition to the fertilizer.

Bernard J. Morzuch, Dept. of Agricultural and Resource Economics, Agricultural Economics, project expert on economic analysis, will perform cost feasibility analyses for the project, including the cost to produce and market fish hydrolysate fertilizer in competition with inorganic fertilizers. Will project costs for all fish hydrolysate formulations developed. Will develop cost comparisons for low-input versus current practices on the bog systems as a whole.

Ronald P. Athanas, Extension Administrator, Extension Marine Resource Program and Northeastern Region Extension, Marine Station, P.O. Box 7128, Lanesville Station, Gloucester, MA 01930, will act as production coordinator for the fish hydrolysate fertilizer -- contact person between academic researchers, the fisheries industry and commercial producers of fish hydrolysate fertilizers. He is responsible for dissemination of results from fish hydrolysate fertilizer production experiments to the

fisheries industry to encourage commercial production of low-cost fish hydrolysate fertilizer. Oversee studies to determine the optimum pH and shelf-life for the fish hydrolysate fertilizer as well as the investigation of fish hydrolysis using various processing equipment and enzymes. Facilitate movement of new fish hydrolysate fertilizers from the laboratory to the farm.

Randolph T. Hatch, Biotechnica International, 85 Bolton Street, Cambridge, MA 02140, Program Director, fermentation and biochemical engineering, will coordinate mass production of the three microbial fungicide candidates for fieldtesting. Will formulate the microorganisms in their most suitable state for ease of application, best disease efficacy.

Ocean Spray Cranberries: 1 Ocean Spray Drive, Lakeville-Middleboro, MA. Each of these Ocean Spray scientists is responsible for the coordination of best management practices related to their respective expertise for Ocean Spray cranberry growers throughout the United States and Canada. Thus, they will provide not only expertise, but a line of communication to all Ocean Spray growers in North America.

Charles C. Kusek, Crop Protection Specialist in Plant Pathology: Project expert on epidemiology, spore trapping, and flooding practices (late water). Cooperator for resistant varieties. Will assist in the identification of disease problems on the experimental sites. Will participate in the design of mycoherbicide experiments.

Lawrence J. Dapsis, Entomologist and IPM Coordinator: Project expert on biorational approaches to insect management (microbials, nematodes, growth regulators). Will cooperate on cranberry fruitworn pheromone identification, trap development, and pheromone disruption techniques with NJ growers.

Joan R. Davenport, Agricultural Specialist, Soil Specialist: Project soil expert, involved in water quality portion of the project as pertains to movement of fertilizer elements, including leaching studies of fertilizers developed.

Rutgers University, New Jersey: Allan W. Stretch, Cranberry and Blueberry Research Center, Penn State Forest Road, Chatsworth, NJ 08019. Will design on-farm experiments for the biological control of berry rot. Experiments will target organisms which have economic impact in both Massachusetts and New Jersey cranberry bogs. Experiments will be carried out as plots on the low-input bogs. Along with Edwards, will communicate project results in New Jersey.

Nicholi Vorsa, Plant Breeding, Associate Director of the Cranberry and Blueberry Research Center, will provide selections with potential resistance to fruit rot. Will consult on use of resistant varieties.

Cooperators:

Ocean Crest Seaford: Edward McCollum, Owner and Treasurer, 88 Commercial Street, Gloucester, MA 01930. Will produce and provide currently available types of fish hydrolysate fertilizer for the low-input bogs. Will consult regarding feasibility of new formulations/techniques resulting from this project.

Farmer Participants (Cranberry Growers):

Decas Cranberry Company: John C. Decas, 219 Main Street, Wareham, MA 02571. Provides acreage for experimental sites, low-input and current-practice, including on-farm demonstrations. Acts as a member of planning team for management of low-input sites. Manages current-practice sites. As an influential independent Massachusetts grower (i.e., a non-Ocean Spray grower), disseminates information to non-Ocean Spray growers.

Gilmore Cranberry Company, Inc.: Kirby S. Gilmore, 670 Neck Road, Rochester, MA 02770. Member of planning team for low-input site management. As a member of a cranberry company that has instituted water preservation initiatives, acts as a resource for ideas/potential problems regarding reduced-input cranberry farming.

Beaton's Cranberry, Inc.: Douglas R. Beaton, 2417 Cranberry Highway, Wareham, MA 02571. Provides acreage for experimental sites, including component research and whole farm management. Member of planning team for low-input site management. Active and influential in the Massachusetts cranberry growing community as a member of the Boards of Ocean Spray and the Cape Cod Cranberry Growers' Association, he will be important in communicating project results to other growers.

Overview

Low-input cranberry production is being demonstrated at four commercial bogs due to implementation of this project in 1990. A fifth site, under traditional management, is serving as a check bog. In comparison to bogs under IPM programs, significant reductions in pesticide and fertilizer inputs were achieved with no loss in fruit quality. Improved water quality was demonstrated in this first year and change in water quality continues to be a key objective owing to the intensive use of surface water in cranberry production. Due to the perennial nature of the crop, cranberry management systems must be evaluated over time (four to five years) before economic and productivity data become meaningful to growers. Thus, we are seeking the maximum continuation of 2.5 years.

The northeast is the world's largest cranberry growing region; however, bogs are concentrated in environmentally sensitive areas (NJ Pine Barrens, MA estuarine drainage basins). Environmental concerns pose a threat to cranberry farming by current practices that require intensive chemical inputs (ca. 2,500 tons of farm chemicals annually in the northeast) to maintain high yield. On the other hand, the market for cranberry products is increasing

and the economies of growing regions are heavily dependent on cranberry growing, directly and indirectly. In order to preserve the environment, as well as the cranberry industry, chemical inputs in cranberry cultivation must be lowered while preserving the profitability of this form of agriculture.

Our goal remains the demonstration of low-input efficacy/profitability in cranberry production. Many of the scientists working on this project are involved in research aimed at lowering chemical inputs (mycoherbicides, disease-resistant varieties, biocontrols, non-chemical fertilizers). However, the majority of these techniques are unrefined and/or untested. This is the focus of the component research objective for the project, with a major focus to develop a novel type of fertilizer that is more efficient than current formulations, thus allowing substantial lowering of doses. Our long-term goal is to study low-input cranberry production from a whole-farm perspective, integrating, demonstrating and evaluating (including economics) prior and concurrent research in consultation with growers.

Objectives

(1) Continue demonstration of low-input practices, implement all low-input/sustainable methodologies as they become available through component research, and compare the results of these practices to results in bogs managed by currently accepted practices.

(2) Continue to quantify effects of low-input production.

(3) Produce further economic analysis of low-input production.

(4) Continue to carry out demonstrations and communication.

(5) Continue to conduct concurrent research projects:

a. Weeds
b. Diseases
c. Insects and Mites
d. Fertilizers

Project Duration: One year and seven months

Funding: $60,000 in 1990; $68,458 in 1991. Matching, $229,340.

Organization	Sustainable Agri. Funds	Matching Funds
University of Massachusetts	$128,458	$229,340
Totals	$128,458	$229,340

LNE91-27: AN INTEGRATED RESPONSE TO POLLINATION-RELATED PROBLEMS RESULTING FROM PARASITIC HONEY-BEE MITES AND THE AFRICANIZED HONEY BEE

(Revised 4/14/93)

Major Participants:

USDA/ARS Bee Research Laboratory: Nicholas W. Calderone (Project Coordinator), Building 476 BARC-EAST, Beltsville, MD 20705, Phone: (301) 344-3974. Overall project coordinator and coordinator of demonstration breeding project and co-coordinator for evaluation of botanicals. G.C. Marten, Associate Director, USDA/ARS Beltsville Area, Rm. 402 NAL, Phone: (301) 344-3193.

Cornell University: Lois Schertz Willett, Dept. of Agricultural Economics, Warren Hall, Ithaca, NY 14853-7801, Phone: (607) 255-4489, coordinator of economic analysis.

University of Maryland: Gordon Allen-Wardell, Extension Apiculturist, Apiculture Building, College Park, MD 20742-5575, Phone: (301) 405-3953, co-coordinator for evaluation of botanicals; coordinator of educational program.

University of Delaware: Dewey Caron, Dept. of Entomology and Applied Ecology, 248 Townsend Hall, Newark, DE 19717-1303, Phone: (302) 451-2526. Project cooperator participating in evaluation of botanicals for mite control. Will provide equipment (both from local beekeepers and University facilities) and assist in execution of experiments.

Ohio State University: Sue Cobey, Apiarist, W.C. Rothenbuhler Honey-Bee Laboratory, Columbus, OH 43210, Phone: (614) 292-7928. Project cooperator participating in the evaluation of stock for inclusion in the closed-breeding-population for tracheal mite tolerance. Will provide colonies and time for the evaluation of 100 honey-bee queens for mite tolerance.

Pennsylvania Dept. of Agriculture: James Steinhauer, Apiary Inspector, Commonwealth of Pennsylvania, Dept. of Agriculture, Bureau of Plant Industry, 2301 North Cameron St., Harrisburg, PA 17110-9408, Phone: (717) 787-4843. Project cooperator participating in evaluation of botanicals for tracheal mite control. Will contribute the use of colonies, time for management of colonies and assist in data collection.

Rutgers University: Frank Wojcik, Apiarist, J.B. Smith Hall, Cook College, Dept. of Entomology, Georges Rd., New Brunswick, NJ 08903, Phone: (201) 932-9564. Project cooperator participating in the evaluation of stock for inclusion in the closed-breeding-population for tracheal mite tolerance. Will provide colonies and time for the evaluation of 30-50 honey-bee queens for mite tolerance.

Farmer Participants (Beekeepers):

Beekeepers are participating in evaluation of botanicals for tracheal mite control. They will contribute the use of colonies, time for management of colonies and assist in data collection.

Ernest H. Miner, Jr., 9933 Kelly Road, Walkersville, MD 21793, Phone: (301) 898-9290.

Al Carl, Round Hill Orchards, Douglas Rd., Southampton, MA 01073, Phone: (413) 562-4985.

Overview

This project is addressing pollination-related problems from four perspectives. It is demonstrating a honey bee breeding project designed to develop mite-tolerant bees and offer alternative mite controls; it is evaluating naturally occuring plant compounds for mite control; it is developing an expert system model for bee keepers; and it is developing an educational video and booklet to help growers evaluate rented colonies.

Honey bees provide essential pollination for over 90 commercial crops in the US. The added-value attributable to honey-bee pollination is estimated to be $19.9 billion. Farmers receive this service at a cost of only $50 million -- a return of nearly $398.00 for every dollar invested. The recent introduction of two parasitic honey-bee mites, coupled with the arrival of the Africanized honey bee in the southern US, threatens to destabilize the crop production system by reducing the number and quality of colonies available for pollination.

Mites kill colonies. One chemical agent is presently available for control of each mite. This leaves the agricultural community at risk should the mites evolve resistance. Africanized bees are not manageable for pollination. Recent evidence demonstrates extensive hybridization of Africanized and domestic stocks in Argentina. North American honey-bee stocks are of the same origin as domestic Argentinean stocks. Consequently, extensive hybridization with North American stock can be expected. Queen- and package-bee producers in the US do not possess the skills to protect the germplasm of their production stocks from

introgression by this undesirable germplasm. These developments seriously compromise the ability of beekeepers to provide high-quality, manageable colonies for pollination.

We propose a comprehensive package to resolve the pollination-related problems facing the agricultural community. A demonstration honey-bee breeding project will be established. Screening a large number of colonies for mite-tolerance will provide stock for incorporation into a closed-breeding-population maintained by instrumental insemination and genetically isolated from undesirable germplasm. Seminars will be conducted to facilitate the transfer of skills required for selection and maintenance of a closed-breeding-population to the queen- and package-bee industry. Africanized-free, mite-tolerant stock will be made available to the industry.

Screening assays conducted at the ARS Bee Research Lab in Beltsville, MD identified several botanical compounds with low mammalian toxicity and significant acaricidal activity. Field trials will be conducted to evaluate the efficacy of these compounds as mite control agents in full-sized colonies.

Maximizing the efficiency of beekeeping operations has become a critical concern. We propose to conduct an economic analysis of mid-sized, regional beekeeping operations to determine relationships among economic variables affecting operating efficiency. We will develop a user-friendly, computer-based Expert System model, based on that economic analysis, for use by beekeepers to enable them to make more efficient operating decisions.

As the number and quality of colonies available for pollination diminishes, the proper management of remaining colonies becomes critical. Equally important is each grower's ability to judge the quality of rented colonies. We propose an education program that addresses these needs. First is a demonstration of techniques to help beekeepers maximize the efficiency of colonies used for pollination. Second is a demonstration to teach growers techniques for evaluating rented colonies.

Objectives

(1) The development of mite-tolerant, Africanized-free, honey-bee breeding stock.

This project will be conducted as a demonstration project and will serve as a mechanism by which to transfer closed-breeding-population technology to private-sector, queen- and package-bee producers. It is anticipated that a significant portion of the queen- and package-bee industry will shift to more northerly states, including the northeast. Therefore, not only will our demonstration project ensure the availability of manageable, mite-tolerant stock for pollination services, it will also act as a technical resource, assisting the development of a new industry in the region.

(2) The evaluation of naturally occurring, botanical compounds, with low mammalian toxicity, for control of parasitic mites.

(3) An economic analysis of the requirements for the successful operation of mid-sized, regional beekeeping operations.

These operations must be capable of meeting the pollination demands of growers in the northeast in a more efficient manner than is achieved with current practices; and a computerized, user-friendly, Expert System model based on that analysis for use by beekeepers to assist them in maximizing the efficiency and productivity of their operations.

(4) The development of an educational/outreach program to:

(a) assist beekeepers in managing their colonies in a manner that maximizes their value as pollination units, and

(b) help growers become knowledgeable consumers of pollination services.

Results to Date

A program has been developed in response to the pollination related problems facing the agricultural community. A demonstration, honey-bee breeding project has been established. Approximately 100 colonies are in the first year of a two-year screening program for mite-tolerance. The best stock will be incorporated into a breeding-population maintained by the use of isolated mating stations, genetically isolated from undesirable germplasm.

Screening assays conducted at the ARS Bee Research Lab in Beltsville, Md., identified several botanical compounds with low mammalian toxicity and significant acaricidal activity. An initial field trial was conducted to evaluate the efficacy of these compounds as mite control agents in full-sized colonies. A second round of trials is currently underway. Several of these compounds were also found to be effective in lab assays against the honey-bee pathogens causing chalkbrood, American foulbrood, and European foulbrood. This suggests that the complex of honey-bee parasites and pathogens may be controlled using a protocol combining a reduction in total pesticide load with environmentally safe chemicals.

An economic analysis of beekeeping operations is being conducted to determine relationships among economic variables affecting profitability. This analysis is based on data collected from 474 beekeepers and is nearly complete. In the second year, we will develop a user-friendly, computer-based 'expert system' model based on that economic analysis. The model will enable beekeepers to make more efficient operating decisions. The proper management of colonies becomes critical as their number and quality diminishes. Equally important is the grower's ability to judge the quality of colonies rented for pollination. An education program addressing these needs is being developed. A script for a 30-minute video instructing growers on techniques for evaluating colonies has been developed and has been sent out for review.

Project Duration: March 1, 1992 through March 31, 1994

Funding: $100,000 for two years. Matching: $284,376.

1993 SARE Grant Amount: $39,250 (funding for two years to completion of project). Non-federal matching funds: $24,484. Other federal funds: $69,501.

Organization	1991-1992 SARE Funds	Matching Funds
University of Maryland	$15,299	$73,708
USDA/ARS	50,760	159,955
Cornell	33,941	50,713
Totals	$100,000	$284,376

LNE91-28: THE NORTHEASTERN FARMER-TO-FARMER INFORMATION EXCHANGE

(Revised 4/14/93)

Major Participants:

Natural Organic Farmers' Association Interstate Council: Margaret Christie, R137 Hyde Hill Road, Williamsburg, MA 01096, Phone: (413) 268-3824.

Workshop Coordinators: Alex Stone, farmer and NOFA/MA Certification Committee Member, Box 1021, Belchertown, MA 01007.

Enid Wonnacott, NOFA/VT State Coordinator and Certification Field Inspector, RR 1, Box 177, Richmond, VT 05477.

University of Vermont: Vernon Grubinger, Small Fruits and Vegetables Extension Specialist, UVM Cooperative Extension, West Brattleboro, VT 05301.

University of Massachusetts: Ruth Hazzard, Vegetable IPM Coordinator, Dept. of Entomology, Amherst, MA 01003.

Overview

The Natural Organic Farmers' Association Interstate Council consists of representatives from organic grower organizations from seven Northeastern states. The Council is proposing to test and evaluate a model for farmer-to-farmer education which meets the following goals: 1) to facilitate information transfer between farmers and 2) to improve organic production practices. Ten grower meetings will be held over two years, focusing on organic management of four pre-selected crops: apples, strawberries, sweet corn and livestock herds (health). At these forums, farmers will meet with other farmers and agricultural professionals. Changes made in the production practices of participating farmers as a result of the meeting will be reviewed following the growing season. The success of this model at accomplishing the above goals will be evaluated by the participants and the model will be refined based on this assessment.

Many organic farmers have been experimenting with innovative techniques for years but need more effective ways to transfer this information to other farmers and to gain valuable information from agricultural professionals. Some growers living in states which require whole-farm organic certification have found that their entire farm is ineligible for certification because they produce one crop which is difficult to grow organically. Other growers are actively looking for alternatives to production methods which, though organically acceptable, may not be environmentally benign, economically viable, or wholly effective. One participant in a pilot apple grower meeting held in March 1990 described this model as a "simply solid structure for.... constructive communication." If further testing and evaluation of the model confirm that it is an effective way to transfer information and improve production practices, it could be used by many private organizations, Extension agencies, or other state or federal programs working with farmers.

Objectives

(1) Test and evaluate a farmer-to-farmer model for the exchange of information on organic production practices and identify future applications for this model.

(2) Improve organic production methods for selected crops through grower-to-grower exchange of information.

(3) Link researchers and other agricultural professionals (extension, land grant, IPM) with organic farmers, and link farmers with other farmers to share strategies and experiences.

Results To Date

Eight to 12 growers of each commodity met for much of two days in the winter of 1992, and will meet again in 1993. At the request of the farmer participants, resource people were also invited to attend. These included researchers, faculty, IPM specialists and

Extension agents from land grant universities, professional organic farming technical advisors, representatives of state departments of agriculture, and farmers recommended by others because of their experience and knowledge. Each meeting had two facilitators who assisted farmers in setting and following their agenda and moderated the discussions. Resource people sometimes made informal presentations but primarily were participants in discussions.

Each meeting ended with a planning session on follow-up activities. These activities varied among groups, depending on the particular interests of the participants. All growers planned to test some of the techniques and ideas discussed at the meeting on their own farms; the results of these informal trials will be discussed at the 1993 meetings. Additional activities ranged from IPM scouting training to replicated research trials on research farms and testimony before the National Organic Standards Board on regulations affecting organic livestock producers.

Project Duration: Two years

Funding: $24,856 for the first year; $23,312 for the second year. Matching, $54,890.

LNE91-29: FARMER-TO-FARMER DIRECTORY AND CONFERENCE

(Revised 4/14/93)

Major Participants:

Maine Organic Farmers and Gardeners Association: Eric Sideman (Project Coordinator), Director of Technical Services, P.O. Box 2176, Augusta, ME 04338, Phone: (207) 622-3118. Nancy Ross, Executive Director; Susan Pierce, Special Events Director.

University of Maine: Richard Brzozowski, Cooperative Extension; Matt Liebman.

Maine Dept. of Agriculture: Russ Libby, Research Director.

Maine Association of Conservation Districts: Bill Bell, Executive Director.

Agricultural Council of Maine: Ed McLaughlin, President.

Overview

Surveys of conventional farmers have identified the lack of useful information as the major impediment to adoption of sustainable practices. Furthermore, farmers seeking information have difficulty in obtaining it from traditional sources such as Extension

Educators or farm chemical and feed dealers. Surveys of farmers already using sustainable practices indicate that they have relied on other farmers for guidance. The conclusion is that the major barrier to conversion is identification of and contact with enough successful growers.

Under the proposed project we will develop a farmer directory that will include short descriptions of individual sustainable practices and whole-farm systems. Sustainable practices will be identified by the major participants including the farm consultant with MOFGA, Extension Educators, the research director at the Maine Dept. of Agriculture and the director of the Sustainable Agriculture Program at the University of Maine. Major participants will use the directory to plan field days on suitable farms.

In order to further facilitate exchange between farmers at different stages of adoption of sustainable practices, we will develop and sponsor an annual farmer-to-farmer conference. The heart of the conference will be direct farmer-to-farmer exchange of information rather than lectures.

The proposed project will be designed to serve other states as a model of low-cost information exchange. MOFGA will work with states interested in developing a directory and conference.

Objectives

(1) Create a directory of farmers who have implemented LISA systems, to include a brief description of each farm and of LISA practices and their effectiveness. Identify farms in the directory suitable for field days and hold field days.

(2) Conduct an annual regional farmer conference to share information on practices, transition strategies, economics, etc.

(3) Develop support materials so that the directory and conference can serve as a model for other states.

Results to Date

At this time, we are in early stages of describing farms and practices for the directory. We have identified and made contact with over 100 farmers to date. Preliminary descriptions of sustainable practices in areas including cover cropping, composting, weed control, erosion control, pest management, livestock nutrition, soil fertility, manure management, and marketing have been received.Work is just beginning on development of the database for the directory. During the winter-summer of 1993 identification and survey of farms will continue. At the same time the description of the practices on the farms will be written and the directory compiled.

The first Farmer to Farmer Conference was held November 14-15, 1992 at Northern Pines Conference Center in Raymond, Maine. Seventy-five farmers participated in a format that integrated lectures, workshops, and open time to maximize farmer-farmer contact. Two Extension personnel and twelve farmers presented and facilitated sessions on poultry, vegetable season extenders, livestock health, flowers for market, maximizing forage and reducing grain, and marketing strategies. The conference was a great success as indicated by early review of the evaluations.

The project will not begin developing support materials until the summer of 1993.

Project Duration: Two years, March 1, 1992 - March 1, 1994

Funding: $8,500 in the first year; $13,000 in the second year. Matching, $26,000.

LNE92-30: DECISION MAKING IN SUSTAINABLE AGRICULTURE SYSTEMS -- PLANNING GRANT

Major Participants:

University of Southern Maine: Michelle J. Hutt, assistant professor of psychology, project coordinator. Will be responsible for experimental design and methodology, developing and administering education curriculum, collecting and analyzing data and disseminating project results.

Guy K. Hutt, director, Wolfe's Neck Farm, Freeport Maine. Will be responsible for experimental design, developing and administering educational curriculum, collecting data and disseminating project results.

Overview

Increasingly, educators acknowledge what researchers in cognitive psychology have consistently found to be true: It is not enough to merely provide students with information. Quality education must also teach participants how to think and solve problems. In situations where the current technology will likely be "obsolete" in 10 years, education that targets ways to process information -- how to think or make decisions-- rather than information alone is likely to be more profitable and successful.

Similarly, research also suggests that individuals at all ages learn best through active, rather than passive, methods. Despite this fact, little has been done to develop such curricula, particularly for adult learners. Most educational experiences for adults involve only lecture or demonstration. This situation is true in the field of sustainable agricultural education.

Today's farmer faces an extremely complex and challenging task in managing a successful enterprise. While technology advances by leaps and bounds, and studies based in the natural sciences proliferate, few inquires into the social science aspects of implementing and maintaining successful agricultural systems exist. Little has been done to understand or to teach agriculturalists how to make effective decisions. Additionally, there is no curriculum that can be used by educators or extension professionals working in the field.

This project will begin to address these issues through a planning grant. Researchers will conduct an exploratory, descriptive examination of what distinguishes two groups of farmers: those who are leaders in adopting sustainable agriculture and those who are continuing with more conventional methods. This information will then be used to design and larger research study into the decision-making process in sustainable agriculture.

Project Duration: One year
Funding: $5,000.

Organization	SARE Funds	Matching Funds
University of Southern Maine	$5,000	$8,400

LNE92-31: DEMONSTRATING THE ECONOMIC AND ENVIRONMENTAL ADVANTAGES OF LEGUME COVER CROPS TO NEW ENGLAND VEGETABLE GROWERS

Major Participants:

University of Massachusetts: Stephen Herbert, Ph.D., professor/Extension agronomist, Dept. Plant and Soil Science. Will serve as project coordinator and conduct Massachusetts field studies.

Francis Mangan, M.S. Dept. Plant and Soil Science.

Mary Jane Else, M.S., Extension IPM Weed Specialist, Dept. Plant and Soil Science.

University of Maine: Matt Liebman, Ph.D., assistant professor, Department of Soil and Environmental Science.

Timothy Griffin, Ph.D., Sustainable Agriculture. Ag. Specialist, Maine Cooperative Extension.

Maine Department of Agriculture: Russell Libby, research director. Will evaluate economics of alternative cover crop strategies.

Maine Organic Farmers and Gardeners Association (MOFGA): Eric Sideman, Ph.D., director of technical services. Observe and monitor cover crop development in farm studies in central Maine. Attend annual meetings of project participants providing linkage between this project and the LISA 'Farmer to Farmer Directory and Conference' project lead by Dr. Sideman.

Rodale Institute: Rhonda Janke, and Mary Ann Sarrantonio, research scientists, Attend annual meetings of project participants providing linkage between this project and other projects on cover crops, supported by the Sustainable Agriculture Program and US AID, at Rodale Institute and in the southern part of the Northeast region.

University of Vermont: Vernon Grubinger, Ph.D., Extension Assistant Professor, Vermont field studies.

Grower Participants:

Tom Calabrese, 257 Feeding Hills Road, Southwick, Massachusetts 01077

Mario Marini, Marini Farms, 253 Linebrook Rd., Ipswich, Mass. 01938

Steve Clegg, 363 Warren Ave., Seekonk, Mass. 02771

Jim Ward, 614 South Main St., Sharon, Mass. 01067

John and Carol Ogonowski, 713 Broadway Road, Rte 113, Dracut Mass.

Al McKinstry, 753 Montgomery St., Chicopee, Mass. 01013

Tom Harlow, Box 134, Westminster Station, Vermont 05759 (Farm is in New Hampshire).

Jack Manix, RD 2, Box 556, Putney, Vermont 053467

Eugene Coombs, Box 2100, Troy, Maine 04987

Larry Allen, Box 178, Westminster Station, Vermont 05159

Paul and Susan Harlow, Harlow Farm, RFD 1, Bellows Falls, VT. 05101

Paul Volckhausen, Happy Town Farm, RR 2 Box 3760, E. Holden, Maine 04429

Garry Gemme, RFD 69, Long Plain Rd., South Deerfield, Mass. 01373

David Holm, Farm Manager, Farm Center, Hampshire College, Amherst, Mass. 01002

Mike Wisseman, 159 Old Amherst Road, Sunderland, Mass. 01357

Arnie Voehringer, P.O. Box 31, Belchertown, Mass. 01007

David Marchant, RR2, Box 3650, Fairfax, Vermont 05454

Research Farms

University of Massachusetts Research Farm, River Road, South Deerfield, Massachusetts.

University of Maine Sustainable Agriculture Research Farm, Bennoch Road, Stillwater, Maine.

UMass. Suburban Experiment Station, Beaver Street, Waltham, Massachusetts.

Overview

As integral components of sustainable agriculture, cover crops reduce erosion and control weeds. In addition, legume cover crops such as hairy vetch, vicia villosa, can reduce farmers' inputs of nitrogen (N) fertilizer. Legumes have proven to be effective cover crops in warm climates, but perceived problems have limited their utilization in New England.

In this project, we will extend information concerning best management practices for cover crops through 17 on-farm demonstrations and eight field studies on three research farms where field days will be held. Our hypothesis is that farmer concerns about insufficient establishment time, winter-killing, and increased weediness with legumes are not justified. Three years of data collected in four New England states have demonstrated the ability of cover cropping systems to reduce N, herbicide and fossil fuel inputs. By establishing on-farm demonstrations and conducting a series of extension activities, including twilight meetings, field day, workshops and information services, we will ensure that our research findings, and those of other researchers, are rapidly implemented by farmers throughout New England.

Emphasis is placed on quantifying N contribution from rates of hairy vetch as low as 20 lbs/acre, which are significantly lower than the previous recommendation of 40 lbs. Seeding rate greatly influences the economics of using cover crops and large expenditures on seed could be an important reason for the lack of adoption of cover cropping practices by many growers. Preliminary studies have shown seeding rates may be reduced without loss in vetch bioassays and N contribution. Should this be feasible throughout the region, hairy vetch/rye cover crops would be more profitable than rye alone.

A second area of emphasis in this proposed project is demonstrating to farmers the potential N contribution and weed suppression effects from winter-killed cover crops. These can be planted into in early spring without knock-down herbicides and little or no tillage.

A third area of emphasis is a comparison of N contribution and weed control from hairy vetch cover crops that are either incorporated into the soil with conventional tillage practices or mow-killed and left as surface mulches for no-till vegetable production systems. Vegetables to be grown following cover crops include beans, cabbage, squash and sweet corn.

This project continues, in part, work initiated under two 1989-91 LISA program grants It is a five state, multi-disciplinary effort involving 17 growers (conventional and organic), three land grant universities, two private agricultural extension/research and education organization, and one state department of agriculture. The total two-year budget of $276,946 consists of $152,039 in matching funds and a request for $124,907 from the Sustainable Agriculture program.

Objectives

(1) Conduct farm-scale demonstrations of hairy vetch/rye cover crops and determine regional variability of hairy vetch nitrogen supplying capacity at varying seeding rates.

Currently winter rye, Secale cereale, is the predominant cover crop used in New England. Three years of research supported by the LISA granting program, however, have demonstrated several benefits of the winter annual hairy vetch not provided by rye. Vetch has provided substantial amounts of nitrogen (N) to the soil, in some situations eliminating the need for additional N fertilizer.

Perceived problems, however, have limited the utilization of vetch and other legume cover crops in New England. Farmers have raised concerns about the high seed cost of hairy vetch, poor fall growth, winter-killing resulting in a lack of spring cover, and a fear of excessive growth in the spring being difficult to incorporate with present tillage equipment.

Hairy vetch has survived harsh winters from Connecticut to Maine and has been successfully integrated into crop rotations by some growers. Our previous research has shown similar N contribution from 20 lbs. of vetch compared to the previously recommended 40 lbs./acre. While it is not known if this N contribution holds true throughout the region, if it does, a clear economic advantage will be demonstrated over rye alone. Therefore, regional variability of N contribution still needs to be determined.

(2) Evaluate (and demonstrate to vegetable growers) hairy vetch/rye and hairy vetch/oat cover crop systems for weed suppression and nitrogen contribution with conventional and reduced tillage systems, and evaluate nitrogen movement toward ground water

To help ensure public support and to benefit from direct marketing opportunities, farms should employ sustainable agricultural practices that minimize hazards to farmers, consumers and the environment. The hairy vetch/rye cover crop has shown promise in controlling weeds when mowed and left as a mulch on the soil surface.

Our preliminary research has shown increased competitive suppression of weeds when legume residues serve as the major N source for crops. Integrated studies are needed to evaluate crop nutrition and weed management in cropping systems dependent on slow release

of N from legume residues vs. rapid release from synthetic fertilizer. Reduced tillage with hairy vetch and winter killed oat (Avena sativa), and mow-killed hairy vetch/rye after rye stem elongation, have been found to reduce herbicide applications and provide some weed suppression. Further investigation of the availability of N from no-till surface mulch systems and seasonal N loss from tilled systems compared to synthetic N fertilizer are needed.

(3) Demonstrate the economic advantage of legume/grass cover crops

To encourage farmers to use alternative cover crops, clear economic advantages must be demonstrated. However, because cover crops increase profits by lowering input costs rather than increasing yields, enterprise budgets for these systems must be integrated into a whole-farm financial analysis to enable farmers to make sound management decisions regarding cover crop practices. To ensure credibility, we will use economic data collected from commercial New England vegetable farms. Finally, even if a new cover cropping system is a biological and economic success, only extensive outreach efforts will ensure widespread adoption. Therefore, as part of this project, we will convene twilight meetings, farm field days, workshops and offer access to written information and researchers in addition to the large farm-scale field plots.

Project Duration: Sept. 1, 1992 through January 31, 1995
Funding: $100,000

Organization	SARE Funds	Matching Funds
MOFGA	$800	
Maine Ag Dept.	$5,300	$1,440
Univ. of Maine	$30,500	$76,405
Univ. of Mass.	$52,600	$67,904
Rodale	$1,800	
Univ. of VT	$9,000	$6,290

LNE92-32: A LIVING LABORATORY/CLASSROOM FOR THE INTEGRATION OF RESEARCH AND EDUCATION EFFORTS ON ALTERNATIVE VEGETABLE PRODUCTION SYSTEMS

Major Participants:

The Pennsylvania State University: Kenneth Steffen (Project Coordinator), Assistant professor of vegetable crop physiology, Department of Horticulture, University Park, PA 16802; Michael S. Dann, project assistant; Shelby J. Fleischer, Assistant professor of entomology; Jayson K. Harper, Assistant professor of agricultural economics; Felix L. Lukezic, Professor of plant pathology; Jonathan P. Lynch, Assistnt professor of plant nutrition; and Michael D. Orzolek, Professor of horticulture.

County Extension:

Jeff Mizer, Multi-county Extension agent, Snyder County Courthouse, PO Box 217, Middleburg, PA 17842.

Farmer Participants:

Jim Crawford, Organic grower of vegetables and fruits, HCK 71, Box 168B, Hustontown, PA 17229.

Sam Everhart, Mixed-grain livestock, processing vegetable grower, 3261 Shingletown Rd, State College, PA 16801.

Ward Sinclair, Organic grower, Flickerville Mt. Farm & Groundhog Ranch, Route 1, Village of Dott, PA 17267.

Paul Zimmerman, Fresh-market vegetable grower, RD 3, Box 186, Mifflinburg, PA 17844.

Overview

Participants will evaluate ecological, agricultural and economic performance of five vegetable production systems ranging from a certified organic operation to conventional agrichemical and tillage system.

There are a number of obstacles to efficient development of more sustainable vegetable production practices. First, is the lack of scientific information on the relative ecological, agricultural and economic performance of current vegetable management systems, which hinders implementation of practically tested approaches. Secondly, is the lack of research data on the complex interactions occurring within vegetable crop ecosystems, which hinders the development of innovative and more sustainable approaches. thirdly, is the lack of

understanding among the general public of either agricultural production or the research process, which creates an atmosphere of uncertainty that adversely effects the soundness of legislative policy. There is an urgent need to address these problems in a timely fashion. Environmental groups are primarily concerned about irreparable damage to our natural resource base, while agricultural groups are primarily concerned with protecting their livelihood in the face of restrictive legislation. this project proposes to expand research on an integrated research/teaching platform or 'living laboratory/classroom' for the evaluation and development of innovative vegetable production strategies. this platform, which currently represents a two-year multidiscplinary and grower research effort, consists of four adjacent fields in a four year rotation of vegetable crop. Three soil management approaches and three pest management approaches are combined to create five different management systems which range from 'certified organic' to conventional agrichemical and tillage approaches. In addition, four plots per replication are available for single component variations of the five main approaches. Baseline data are continually monitored on economic of all inputs, weather, plant growth and development, soil properties and nutrients, arthropods, pathogens, plant tissue nutrients, yield and quality, human nutritional quality, consumer acceptance, post-harvest storability, and projected economic returns. Priority research areas have been identified, and investigators will use these baseline data, and studies embedded into the platform and on grower's fields, to improve water use efficiency, nutrient cycling, nonchemical weed control, environmentally benign disease control, arthropod ecology and management, and production economics of alternative vegetable production systems. Repeated, structured in-field educational programs are designed as part of the research/teaching platform as well as newsletters, and Extension programming to ensure an evolution of alternative vegetable production systems.

Objectives

1. To **evaluate** the ecological, agricultural, and economic performance of alternative vegetable production systems, comprised of generally tested and newly developing practices, as well as single-component variations of these systems.

   Baseline Data to be Collected:

   a. all inputs (amounts and cost) of labor, equipment, and materials
   b. official weather station data
   c. plant growth and development
   d. soil properties and nutrient analyses
   e. arthropod density and damage
   f. pathogen epidemiology and plant damage
   g. plant tissue analyses
   h. yield and grade of produce
   i. produce nutritional quality
   j. consumer acceptance of produce

k. post-harvest storability of produce
l. projected economic returns

2. To **investigate**, using a focused team approach, complex biological processes and their economic implications in high-value, vegetable production systems in order to develop more resource efficient and environmentally sound management systems.

Priority Research Areas to be Studied:

a. water use efficiency
b. nutrient cycling
c. nonchemical weed management
d. environmentally benign materials for disease control
e. arthropod ecology and management
f. production economics

3. To **involve** the general public (rural and urban dwellers, legislators, growers, extension agents, students, other researchers) in agricultural research as an integrative interactive process.

Educational Mechanisms Utilized in 'Living Laboratory/Classroom' Platform:

a. series of workshops in field platform and classroom
b. closely-linked cooperating farm tours
c. quarterly newsletter of progress in platform and cooperating farms
d. winter conference on platform results, sustainable vegetable production, and future plans

Project Duration:

Funding: 1993 SARE Grant Amount: $120,000 for one year. Non-federal matching funds:

LNE92-33: FUNGAL PATHOGENS FOR BIOCONTROL OF WESTERN FLOWER THRIPS AND GREEN PEACH APHID IN GREENHOUSES

Major Participants:

University of Vermont: Bruce L. Parker Ph.D., professor of entomology, and Michael Brownbridge, Ph.D., research assistant professor and insect pathologist, co-investigators. Also: Margaret Skinner, M.S. laboratory and field technician; John P. Hayden, M.S., research technician; Donald L. McLean, entomology professor; Leonard Perry, Ph.D., extension horticulturist and greenhouse specialist.

Cornell University: Gerard Ferrentino, M.S., specialist in greenhouse IPM; John P. Sanderson, Ph.D., IPM greenhouse specialist. Jennifer A. Grant, greenhouse Extension specialist, Geneva Experiment Station.

USDA-ARS: Richard A. Humber, Ph.D., specialist in taxonomy of insect fungi.

Adrian T. Gillespie, Ph.D., insect pathologist for Chr. Hansen's Biosystems, Denmark, a commercial producer of Verticillium lecanii in Europe.

Grower Participants:

David G. Marshall, greenhouse manager, Mailloux Greenhouses Inc., Ferrisburgh, VT.

Chris Conant and Thomas J. Doubleday, Claussen's Florist and Greenhouse, Colchester, Vermont.

Overview

Western flower thrips (WFT) and the green peach aphid (GPA) are major economic threats to the greenhouse industry. Control with conventional techniques is difficult, costly and often ineffective. Furthermore, it is complicated by the development of insecticide resistance. Innovative approaches to management are needed.

Our objectives are to investigate the insect pathogenic fungi Verticillium lecanii, Beauveria bassiana, Metarhizium anisopliae and Paecilomyces farinosus for ultimate incorporation into greenhouse IPM strategies.

We have already shown that a number of our fungal isolates are highly pathogenic to WFT. Bioassay tests will allow us to select the most lethal and versatile ones for evaluation in greenhouse pilot tests. We will study the performance of select isolates against WFT on plants and in the soil. This will enable us to identify strains that are efficacious and the insect stage that can be most effectively targeted for WFT management. We will determine the persistence of fungal inoculum in soils to ascertain if stable fungal populations develop to provide a long term reservoir of infective material and ultimately how often treatments should be applied

Preliminary pathogenicity studies indicate that a number of the WFT-active fungal strains are also active against GPA. Additional fungal isolates need to be screened and quantitative bioassays performed. With this broad base of strain types, we will be able to identify the best and most suitable strains for management. By initially selecting WFT-pathogenic strains, we will also be able to show which strains have potential for use against other pests, making them more cost-effective for greenhouse use.

Objectives

(1) Determine the on-plant efficacy of select fungal isolates against western flower thrips (WFT).

In our research on the biological control of pear thrips, Taeniothrips inconsequens, a new pest of sugar maple, we discovered strains of the fungus Verticillium lecanii causing significant mortality. We have found that these strains are highly pathogenic to WFT. In fact, they are significantly more pathogenic than other V. lecanii strains, including those presently used commercially in European greenhouses.

WFT has become one of the most serious pests in the greenhouse industry. It attacks virtually all floricultural crops, and in the East is the primary vector of the tomato spotted wilt virus in ornamental and vegetable plants.

Damage thresholds for floricultural crops are low or nonexistent, particularly for pests like WFT that attack the flower - the most important part of these aesthetic crops. Flower damage results in reduced yields, lower market values and increased costs for repeated pesticide applications.

Chemical control of WFT is hard to ensure because the insect hides deeply in plant crevices making contact with pesticides difficult. Additionally, WFT develops resistance quickly. Reinfestation through migration into greenhouses is an additional problem.

Entomopathogenic fungi offer a viable biocontrol option as they are particularly well-suited to humid greenhouse conditions, and some species are relatively easy to mass produce. Pathogenicity varies among V. lecanii strains and among other entomogenous fungi so screening and evaluation is essential for development.

The pathogenicity to WFT of 11 V. lecanii isolates, and three strains of Beauveria bassiana (two from thrips) and Metarhizium anisopliae has been demonstrated. Each has specific biocontrol merits and we need to further select and develop them for greenhouse use.

WFT is found on plants and in soil, so we will evaluate the performance of select pathogens against stages found in these two environments. This will provide information that will enable us to identify which strains should be used, and the insect stage and greenhouse habitat to target.

(2) Determine the persistence of fungal inoculum in greenhouse soils.

Infection in soil of WFT and other greenhouse pests is dependent on contact with sufficient infective units. Persistence of infective propagules in soil increases the probability of contact with a susceptible host, thereby enhancing the possibility of infection.

Soil provides favorable moisture and temperature for persistence of fungal conidia and is the natural reservoir of fungi such as B. bassiana, M. anisopliae and V. lecanii. Conidia of B. bassiana persist in soil for 2 years, and M. anisopliae can survive and multiply in the soil over time. The survival of V. lecanii is uncertain, though we know it is strongly influenced by soil factors. Information on the survival of fungal inocula is essential to ascertain how often treatments should be applied and whether a stable population is present to provide a long term reservoir of infective material.

We recognize that the situation in a greenhouse will differ according to spray practices and the compatibility of our fungi with other treatments must be assessed in future research. On-plant persistence and the transmission of the disease within a pest population must also be addressed. It is essential first, that the reaction of the fungi in a controlled environment be determined. Ultimately,, it will be possible to make recommendations to alter management practices to enhance their persistence.

(3) Determine pathogenicity of select fungal strains against the green peach aphid (GPA).

GPA is one of the most destructive pests of greenhouse vegetables and flowers in the Northeast. In this protected environment, its reproductive potential is such that destructive populations can build up within a matter of days. Economic damage results from direct removal of plant nutrients causing premature plant senescence, by excretion of honeydew on which unsightly sooty mold grows, and through transmission of plant viruses. Over 100 viruses are vectored by GPA to a variety of covered crops. Damage resulting from disease transmission is often more dramatic than direct feeding injury.

GPA preferentially feeds on the underside of leaves or in flowers, avoiding contact and limiting the efficacy of insecticides; and resistance develops quickly. Production and distribution of plants by large-scale propagators using intensive spray regimes contributes to the rapid development and spread of resistant strains.

These problems could be minimized by using entomogenous fungi, especially if they could become established in the pest population. V. lecanii is pathogenic to GPA, and control of aphids has been achieved in greenhouses in Europe. However, variation in the pathoenicity and disease-spreading potential of different V. lecanii isolates has been documented.

Some of our V. lecanii isolates from pear thrips are pathogenic to GPA. In addition, a number of B. bassiana, M. anisopliae and Paecilomyces farinosus strains, isolated from Vermont forest soils and forest insects, have recently been shown to be pathogenic to GPA in preliminary screening assays. B. bassiana and M. anisopliae also show variance in pathogenicity to aphids, so further screening assays against GPA, followed by bioassays of promising isolates, are required. With this broad base of strain types, we will be able to identify the best and most suitable strains for management. By initially selecting strains that exhibit toxicity to WFT, we will also be able to show which strains have potential for use against other pests, making them more cost-effective for greenhouse use.

Project Duration: October 1, 1992 through September 30, 1994.

Funding: $79,709.

Organization	SARE Funds	Matching Funds
University of Vermont	$79,907	$44,851

LNE93-34: AN INTEGRATED EXTENSION/RESEARCH PROGRAM FOR REPLACING HERBICIDES WITH MECHANICAL CULTIVATION IN NEW YORK STATE

Major Participants:

Cornell University: Jane Mt. Pleasant (Project Coordinator), Soil and Cropping Systems Management, 60% Extension, 40% Research., Dept. of Soil, Crop and Atmospheric Sciences, 146 Emerson, Ithaca, NY 14853, Phone (607) 255-1755; FAX: (607) 255-2644. Will provide leadership to implement educational objectives, including cultivation clinics, on-farm trials, and farmer-to-farmer information network. Will also assist in research objectives with major responsibility for the time of cultivation experiment.

Charles L. Mohler, Plant Ecology and Non-chemical Weed Control Systems, 85% Research, 15% Teaching, Section of Ecology and Systematics, Division of Biological Sciences. Will provide leadership to implement the research objectives, including major responsibility for the cultivator comparison experiments. Will act as primary liaison with equipment manufacturers, and assist with implementation of the educational objectives.

James Frisch, Soil Crop and Atmospheric Sciences, will conduct on-farm trials and assist with all phases of the project.

Cooperating Manufacturers:

All of the listed businesses are providing equipment in support of the proposed work.

Allied Products Corporation (Bush Hog / Lilliston): Robert Moore, Vice President of Sales, Bush Hog, Inc., PO Box 1039, Selma, AL 36701.

Bezzerides Brothers, Inc.: Paul A. Bezzerides, President, PO Box 211, Orosi, CA 93647.

John Deere & Company: Richard Johnson, John Deere & Co. Technical Center, 3300 River Drive, Moline, IL 61266-1792.

The Lely Corporation: Ed Culler, Product Manager, Box 1060, US 301 South, Wilson, NC 27894-1060.

King Ferry Implement Corporation (a Case International dealership): Route 34B, King Ferry, NY.

Overview

This project is designed to help farmers find out how to introduce mechanical cultivation into a variety of cropping systems and fine-tune machinery for their needs. Participants will hold a series of winter cultivation clinics, help establish a farmer-to-farmer information network and sponsor summer field tours of on-farm trials and demonstration plots. The information and techniques presented will be based on research which has recently been completed or is currently underway at Cornell.

We propose an integrated program of extension and research which will provide farmers in New York State with the information on mechanical cultivation necessary to reduce reliance on herbicides for weed control. Currently, weed control on approximately 1,000,000 acres of field corn and several hundreed thousand acres of other row crops grown in the state is accomplished almost entirely through the use of herbicides. Farmers are now seeking information about cultivation in order to reduce production costs and pollution, and to avoid regulatory problems associated with use of herbicides, but information is not readily available to them. Any substantial shift from herbicides to mechanical cultivation will reduce the amount of pesticides released into the environment by many millions of pounds per year.

The extension component of the program, based on research which has recently been completed or is currently underway at Cornell, will educate farmers and extension personnel through aseries of winter cultivation clinics, a farmer-to-farmer information network, and summer field tours of on-farm trials and demonstration plots. All of these activities will be supported with clearly written and well illustrated educational literature describing types of machinery availaable, best ways to set up and fine tune machinery for farming in New York conditins, how to introduce mechanical cultivation into a variety of cropping systems, problem solving and other topics of interest to farmers who desire to initiate or expand use of cultivation on their farms.

The research component of the program continues work begun with seed money from the Cornell Experiment Station and in-kind support from serveral manufactures. It consists of both replicated on-farm trials and larager experiments at a centrally located experimentstation farm. On-farm trials at three locations will examine and demonstrate the use of cultivation at various stages of crop development in conjuction with herbicide bands of various widths. Experiments at a central location will (1) compare several systems for mechanical control of weeds within crop rows and (2) compare tools for cultivation in minimumm tillage/high residue conditions. In addition to providing systematic information for use in the extension program, both on-farm and experiment station trials will be viewed by farmers and conty extension personnel. Publication of research findings in professional journals and popular magazines is expecged to spread the impact of the work well beyond New York State.

Objectives

1. Education on cultivation for farmers in New York.

2. Comparative research on cultivation methods.

Project Duration: Two years, May 1, 1993 - April 30, 1995

Funding: $103,235 for two years. Non-federal matching funds: $70,246.

LNE93-35: DEVELOP CROP ROTATIONAL BUDGETS FOR THREE CROPPING SYSTEMS IN THE NORTHEAST

Major Participants:

Rutgers University: Robin G. Brumfield (Project Coordinator), Extension Specialist in Farm Management, Dept. of Agricultural Economics & Marketing, Cook College, Rutgers - The State University, PO Box 231, New Brunswick, NJ 08903-0231, Phone: (908) 932-9171; FAX: 9908) 932-8887. Coordinates the enterprise budget development, computerization, and workshop programs in the Northeast.

Natural Organic Farmers Association of N.J.: Jennifer Morgan, Program Administrator, NOFA-NJ, RD2, Box 263A, Pennington, NJ 08534. Serve as liaison tocertified organic growers.

Northeast Extension Farm Management Committee:

Pennsylvania State University: Jayson K. Harper, Dept. of Ag. Econ. & Rural Sociology, 202 Armsby Bldg., University Park, PA 16802. Will plan budget development and workshops in the Northeast and develop enterprise budgets.

University of Massachusetts: Robert L. Christensen, Dept. of Resource Economics, 315 Draper Hall, Amherst, MA 01003. Will plan budget development and workshops in the Northeast and develop enterprise budgets.

University of Delaware: Ton Tilmon, Rood & Resource Economics Dept., 232 Townsend Hall, Newark, DE 19717-1303. Will plan budget development and workshops in the Northeast and develop enterprise budgets.

University of Maryland: Dale Johnson, Dept. of Ag. Y Res. Econ., Symons Hall, College Park, MD 20742. Will plan budget development and workshops in the Northeast and develop enterprise budgets.

University of New Hampshire: Michael Sciabarrasi, Dept. Res. Econ. & Dev., 317 James Hall, Durham, NH 03824. Will plan budget development and workshops in the Northeast and develop enterprise budgets.

University of Vermont: Rick Wackernagel, AREC, 601 Main St., Burlington, VT 05601-1700. Will plan budget development and workshops in the Northeast and develop enterprise budgets.

Overview

This project will develop enterprise budgets for a variety of crop and livestock operations under conventional, reduced-input and organic production systems. It is geared to conventional farmers who are considering switching to low-input or organic production systems.

The Northeastern United States is the most highly urbanized region in the nation. Public concern for both environmental quality and maintenance of a dependable supply of high quality food presents a challenge for the agriculture of the region. This challenge requires that farming systems be developed and implemented that successfully combine environmentally responsible production methods, and management of resources, in a manner that enables Northeastern farmers to successfully compete in regional, national, and international markets. Long-run profitability is the ultimatae determinant of sustainability.

To test profitability and productivity of alternative systems, enterprises budgets will be developed for a set of crop and livestock enterprises under three defined resource management syustems. Enterprise budgets for "conventional," "reduced input," and "organic" production systems will be developed with the assistance of farmers using those practices. The resulting data on inputs and yield experience will be entered into SMART, a national computerized expert system. SMART allows analysis of the whole farm production system and selection of the set of practices that are both ecologically safe and profitable. Illustrative model farming systems for crop and livestock production will be developed that meet specified environmental and profitability criteria. Regional hands-on workshops for Cooperative Extension and other agricultural agency staff will be conducted to make them aware of the results of the research and train them in the use of the SMART system. Extension staff will, in turn, provide training session for farmers and use the SMART system to assist individual farmers in designing production systems appropriate to their farms' conditions. Follow-up sessions will be conducted in which those farmers who made changes in their production systems will descibe the impacts of those changes to other interested farmers. A major focus will be on the changes in resources used in production, profitability, and perceived and/or measured environmental effects.

Objectives

1. To develop enterprise budgets for conventional, reduced input, and organic production systems for the Northeast.

2. To input the enterprise budgets developed in (1) into an expert system for identifying and selecting sustainable practices.

3. To provide training to field educators that prepares them to assist farmers in selecting alternative sustainable production systems appropriate ot individual farm situations.

4. To inform farmers about the relative environmental impact and profitability of alternative systems and help cooperating farmers use the SMART software to design a production system for their farms.

Project Duration: Two years

Funding: $60,846 for two years. Non-federal matching funds: $159,742.

LNE93-36[4]: ECOLOGICAL MANAGEMENT OF POTATO CROPPING SYSTEMS

Major Participants:

University of Maine: Gregory A. Porter (Project Coordinator), Department of Plant, Soil & Environmental Sciences, 5722 Deeting Hall, Orono, ME 04469-5722, Phone (207) 581-2943; FAX: (207) 581-2999. He will supervise crop establishment, crop growth and physiological measurements, and plot harvest. He will be a secondary supervisor of the Scientific Technician and supervise some of the soil analyses. He will report results on crop responses and their relationship to soil physical properties.

C. Wayne Honeycutt, Soil Scientist & Faculty Associate, USDA-ARS, New England Plant, Soil, & Water Lab., University of Maine. He will direct a graduate student in the conduct of the studies below.

An unnamed graduate student will assist in conducting these studies.

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[4] This project LNE93-36 will receive $111,870 of SARE Funds for two years; and as ANE93-18, it will receive $38,130 of ACE Funds for two years. Total Non-federal matching funds $69,000, and Other federal matching funds: $377,971 have not been separated into SARE and ACE amounts yet.

M. Naguib Bedaiwy, Dept. of Plant, Soil & Environmental Sciences, Will conduct most of the soil sampling and analyses of soil physical properties and moisture content. He will be primary supervisor of the Scientific Technician and responsible for operation of the irrigation system. He will report results on soil physical properties.

Jefferey C. McBurnie, Dept. of BioResource Engineering, will conduct soil solution sampling and analyses. He will assist in irrigation system operation, soil sampling and will be a secondary supervisor of the Scientific Technician. He will report results on soil solution nitrate levels and adaptation of the two leaching models.

E. Groden, Dept. of Entomology, is employed as a 50% appointment and so she has budgeted for one month summer salary.

F.A. Drummond, Dept. of Entomology, is employed as a 50% appointment and so he has budgeted for one month summer salary.

M.C. Marra, Dept. of agricultural and Resource Economics, will work with Drummond and Groden.

Overview

This project is part of a larger, interdisciplinary "Potato Agroecosystem" project. SARE/ACE funds will be used to investigate the effects of green manure, compost and manure soil physical properties, and to determine the impact of four biocontrol agents on Colorado potato beetles.

Potato production in the Northeast is frequently chemical intensive and often promotes degradation of soil resources due to intensive cultivation and short cropping cycles. The intensity of chemical use associated with conventional potato production raises questions regarding potential environmental effects and long-term sustainability given increasing concerns about agriculture's impact upon ground and surface water quality, worker safety, food quality, wildlife and fisheries. Soil erosion and loss of organic matter and aggregation can limit productivity of potato soils. Long-term acreage and production trends for potatoes in Maine and the Northeast indicate that new production approaches are needed to improve soil productivity and to retain a sustainable Northeast potato industry.

In this proposal, we request funds for a research project focusing on ecological soil and pest management strategies for potato cropping systems. Funds will be used to enhance the University of Maines's interdisciplinary "Potato Agroecosystem" research project with particular emphasis on expanding the scope of our investigations of soil physical properties and insect biocontrol. Specifically, effects of organic soil amendments on soil physical properties and water holding will be studied with the goal of identifying alternatives to supplemental irrigation while reducing nitrate leaching losses. A multifaceted strategy for biological control of the Colorado potato beetle (CPB) will be examined. The research

involved in this proposal is restricted to experiment station plots because it involves, in many cases, significant alterations of conventional potato production practices. The proposal addresses SARE FY'93 priority areas including: 1) protection of water quality; 2) analysis of economic costs and returns of alterantive management systems; and 3) studies of natural systems, including soil management effects on soil properties, nutrient dynamics, crop responses to alternative management strategies and biocontrol measures. Results of this project will help develop production systems that better maintain or improve soil productivity, and more efficiently control CPB, with reduced reliance upon purchased fertilizers and pesticides.

Objectives

1. Determine the effects of green manure, compost and manure use on soil physical properties, nitrate leaching, and potato plant growth, water status and yield.

2. Determine the impact of two microbial pathogens (*Bacillus thuringiensis* and *Beauveria bassiana*) and two insect predators (*Perillus bioculatus* and *Coleomegilla maculata*), singularly and in combination, on mortality of Colorado potato beetle. Results will be used to develop a multi-tactic biological control program for Colorado potato beetle.

Project Duration: September 1993 to March 1996: Two years as LNE93-36; two years as ACE93-18.

Funding: $111,870 for two years.
Non-federal matching funds: $69,000. **(SARE and ACE combined)**
Other federal funds: $377,971. **(SARE and ACE combined)**

LNE93-37: INTEGRATING STEWARDSHIP FORESTRY INTO TOTAL FARM MANAGEMENT

The Pennsylvania State University: Stephen B. Jones and James C. Finley (Co-Project Coordinators), School of Forestry, 110 Ferguson Building, University Park, PA 16802, Phone: (814) 863-0401; FAX: (814) 865-3725. Jones is Penn State's extension specialist for forest resource sustainablity, timber taxation, and forest based economic development. He serves as co-project director for the educational awareness project of Pennsylvania's Forest Stewardship Program. Finley currently is conducting extension education programs related to the sustainability of forest resources, especially those issues that relate to non-industrial forest landowners. Research interests relate to forest resource sustainability, timber marketing, and extension education.

Overview

Participants will establish six demonstration/research replicates to examine the environmental and economic benefits of proper farm woodlot management. Educational and outreach activities will focus on helping farmers learn how to manage their forests wisely.

Well-managed forests produce many environmental and economic benefits, such as improved air and water quality, wood products, recreational opportunities, and wildlife habitat. Farmers are one of the largest groups of forest landowners in the U. S. and for this and future generations, it is essential that farmers wisely use and manage their forests.

This proposal establishes six demonstration/research replicates to examine the economic and environmental benefits of proper farm woodlot management. Each 12-acre replicate consists of six two-acre treatments: a control and five timber harvesting practices. Growth responses will be measured. Stand structure and species composition are expected to be altered. A full cost and benefit analysis will be included with special emphasis given to how woodlot management fits into the total farm budget.

The installations will demonstrate proper forestry practices to farm woodland owners. The plots will also provide baseline data for long-term monitoring of forest growth and value, and changes in species composition with resulting changes in wildlife habitat and biodiversity.

Objectives

1. Establish six timber harvesting demonstration/study replicates distributed in different forest types in Pennsylvania.

2. Enhance the adoption of aforest stewardship ethic by farmers, timber harvesters, other landowners, and extension agents, by demonstrating the impacts of various silvicultural options.

3. Develop baselline data for monitoring forest growth and changes in species diversity.

4. Determine the economics of sustainable forestry practices and potential contributions to the whole farm budget.

Project Duration: June 1, 1993 - August 31, 1995 (27 months)

Funding: $48,408 for three years. Matching funds: $52,579.

LNE93-38: BIODIVERSITY EDUCATION THROUGH THE PENNSYLVANIA FOREST STEWARDSHIP PROGRAM

Major Participants:

The Pennsylvania State University: Stephen B. Jones and James C. Finley (Co-Project Coordinators), School of Forestry, 110 Ferguson Building, University Park, PA 16802, Phone: (814) 863-0401; FAX: (814) 865-3725. Jones is Penn State's extension specialist for forest resource sustainablity, timber taxation, and forest based economic development. He serves as co-project director for the educational awareness project of Pennsylvania's Forest Stewardship Program. Finley currently is conducting extension education programs related to the sustainability of forest resources, especially those issues that relate to non-industrial forest landowners. Research interests relate to forest resource sustainability, timber marketing, and extension education.

Overview

The goal of this project is to provide professional foresters with a method to rapidly assess the nature and quality of habitat components and to provide private forest landowners, including farmers, with an understanding of biodiversity. Participants will established a biodiversity demonstration site, produce a field manual, hold workshops.

The goal of this proposed project is to provide professional foresters with a methodology to rapidly assess the nature and quality of havitat components and to provide private forestlandowners, including farmers, with an understanding of biodiversity and the potential impact that their activities csan have on biodiversity. education and field demonstrations are proposed for achieving project goals. The project targets Pennsylvania's professional foresters and private forest landowners.

The products of the proposed project will include:

1. An established demonstration site for biodiversity management.

2. A field mannual for use by professional foresters working with private forest landowners; and

3. A two day workshop to train professional foresters in use of the manual.

4. Two one-day workshop modules: one for educating professional foresters in the methods of assessment and management of forestlands for increased biodiversity, and one for presenting the basic concepts of biodiversity and its importance in the woodlot to private forest landowners.

Objectives

1. Develop procedures for assessing biodiversity in farm and private woodlots.

2. Establish a demonstration site for biodiversity management.
3. Develop a field manual for use by professional foresters and landowners to manage for biodiversity.

4. Expand the state's capacity to develop and deliver educational programs on biodiversity.

Project Duration: One year, June 1, 1993 - May 31, 1994

Funding: $23,508 for one year. Matching funds: $18,122.

LNE93-39: SYSTEMS ANALYSIS OF ORGANIC AND TRANSITIONAL DAIRY PRODUCTION

Major Participants:

Natural Organic Farmers Association-Vermont: Enid Wonnacott (Project Coordinator), 15 Barre St. Montpelier, VT 05602. Will be responsible for organizing farmer-training, organizing farm management groups, data collection, case-study preparation and publishing informational documents.

University of Vermont: Neil Pelsue, Associate professor, Agricultural and Resource Economics Department, Adams Building, Burlington, VT 05405. Appointment in research and extension. Responsible for developing and carrying out the economic modelling and analysis, and overseeing the data collection process necessaryto accomplish economic objectives.

Woody Pankey, Research professor, Mastitis Microbiology Department of Animal and Food Sciences. Will monitor udder health and milk quality on all cooperator farms. Will also assimilate and organize all animal health data accumulated by the herd veterinarians on a monthly basis and provide these data to the project coordinator in the Ferow Program format for summary and analysis.

Sidney Bosworth, Extension Associate Professor of Agronomy, Plant and Soil Science Department. Will train farmers in crop record keeping. He is responsible for

collection and analysis of field data, (using the computerized crop record keeping system).

University of Vermont Extension System: Marli Rupe, Regional Specialist, Sustainable Agriculture/Dairy, Howe Center, Rutland, VT 05701. Body condition scoring, ration balancing, forage and grain analysis, feed management and herd management consulting.

Veterinarians:

Michael J Wood, DVM, Cornwall Large Animal Clinic, RD4, Box 120 Middlebury, Vermont 05753. Monitor monthly herd health, provide data from the Fetrow program to the University of Vermont animal health clinic. Consult withfarmers on alternative herd health strategies.

Thomas J. Stuwe, DVM, RD1, Barre, Vermont 05641. Monitor monthly herd health, provide data from the Fetrow program to the University of Vermont animal health clinic. Consult withfarmers on alternative herd health strategies.

Farmer Participants:

Certified Organic Dairy Farmers:

The role of the following farmers: Keeping and providing records on business management, crop management and animal management; improving the research design; annually attending four farm management group meetings; holding or participating in on-farm demonstrations; and providing information to interested non-participating farmers.

Suki Fredericks and James Maroney, Oliver Hill Farm, RR2, Brandon, VT 05733.

Jack and Anne Lazor, Butterworks Farm, Box 15A, Westfield, VT 05874.

Peter Young and Nancy Everhart, Hill Farm of Vermont, RD1, Box 740, Plainsfield, VT 05667.

Peter Flint, Organic Cow Dairy, RFD1, Chelsea, VT 05038.

Transitional farmers will be selected in Fall, 1993.

Overview

Participants will conduct detailed farm management analyses on four certified and four transitional dairy farms to obtain accurate information on the real costs of sustainable

dairy production -- economic, environmental and soil. Because of the diversity of the farms, each will be analyzed as case-studies, providing relevant information for farms with similar characteristics.

With an increasing market for organic and/or premium dairy products as well as the potential for increased environmental regulation and liability, many dairy farmers are seeking accurate information concerning sustainable agricultural practices. A primary question asked by farmers is "how much will this practice cost me and how much will I save?" A practice that is environmentally sound or sustainable may not be economically viable. On the other hand, a practice that appears to be too expensive, may have long term environmental and broad economic benefits.

Cost/benefit analysis can be and has been conducted from the results of component research evaluating specific sustainable practices. However, there has been little work done evaluating the impact of adopting sustainable practices on the total management (ie., human, animal, crop, machinery, etc.) and economy of the 'whole' farm.

Many production practices now termed as sustainable have been practiced by organic dairy farmers for many years. It is our intention to ocnduct a detailed farm management analysis on four certified and four traditional dairy farms over a three year period. Because of their diversity in size and operational characteristics, each of the eight farms will be analyzed as case-studies, providing relevant information for farms with similar characteristics.

An important result of this proposal is to obtain accurate information on the real costs of sustainable dairy production -- economic, environmental, and social -- for the benefit of consumers, producers and the dairy industry. Information will be gathered and analyzed in two manners, quantitatively and qualitatively.

Quantitative information will be obtained by collecting detailed records of costs, labor, time, inputs (ie., seed, fertilizer, fuel, etc.), and production of animal and crop components on each farm. Whole farm financial analysis will be conducted as well as partial budgets of specific components and practices. Whole farm nutrient budgets and conservationpractices will be evaluated for each case-study in order to assess environmental impact.

Qualitative information concerning management will be gathered by holding quarterly information exchange meetings of farmers, consultants and researchers. At these meetings, all parties will be able to share their feelings, frustrations, and accomplishments of sustainable dairy production. In addition, these meetings will be used to identify specific problems and obstacles of sustainabl edairy production. All meetings will be recorded. At the end of the project, we will publish the case studies and sumaries from the meetings. The intended audience will be farmers, consultants, researchers, and policy makers.

Objectives

1. Assess the farm management system of four certifiec organic dairy farms and four transitional dairy farms.

2. Facilitate the exchange of information form farmer-to-farmer, and farmer-to-agricultural professional (Extension, Research, Veterinarian).

Project Duration:

Funding: Grant Amount: $165,000 for two years. Non-federal matching funds: $42,199. Other federal funds: $43,370.

PART III. ACE PROJECTS FUNDED 1991-1993

Table of Contents for Part III

The following are descriptions of all the Northeast Region ACE projects funded from 1991 to 1993, including results from the progress reports received in 1992.

Project ANE91-1: IMPROVING CROP ADAPTATION TO ALTERNATIVE SYSTEMS [1]

Coordinator: Margaret E. Smith, Department of Plant Breeding, Cornell University, 252 Emerson Hall, Ithaca, N.Y.14853. Phone: 607-255-2180

Major Participants: T.C. Barker and W.D. Pardee, Cornell University Department of Plant Breeding; M. van der Gritten, USDA Soil Conservation Service; R.W. Zobel, USDA Agricultural Research Service.

SARE Funding (as LNE90-25): $60,000. **ACE Funding:** $72,947. Matching non-federal funds: $91,016. This project was first funded as LISA project LNE90-25.

Duration: One year SARE, one year ACE.

Project Status: Closed.

Abstract: The objectives of this project were to identify corn varieties that are well adapted to specific low-input or sustainable agriculture practices, and to provide this information immediately to farmers and extension personnel.

Other project goals involved identifying traits critical to improved corn adaptation to sustainable conditions; initiating a corn breeding program to develop new genetic materials adapted to existing and proposed low input sustainable agricultural procedures; and working with farmers, extension agents and seed companies to improve availability of varieties adapted to sustainable systems and ability to choose appropriate varieties.

This work was carried out in four cropping systems: (1) no-till, which received zero tillage and recommended herbicide and nitrogen inputs; (2) low nitrogen, which received full tillage and herbicide inputs, but only a minimal starter nitrogen application; (3) red clover interseeding, which received full tillage, no herbicide, a minimal starter nitrogen application, and medium red clover sown between rows at layby and plowed down prior to planting the following spring; and (4) a conventional check system, which received full tillage and recommended herbicide and nitrogen inputs.

Two major field activities were carried out: an evaluation of current commercially available corn varieties in the four cropping systems studied, and a divergent selection breeding program to develop unique genetic materials with improved performance in specific cropping systems.

After two years of research, progress was made in understanding the interaction between corn varieties and different cropping systems. It is apparent that performance of a variety in a conventional production system is not generally an accurate indicator of how that variety will perform in alternative low-input, sustainable production systems. In other words, the best variety in one system is not necessarily best in other systems.

Some specific traits important to productivity of corn varieties under low-input, sustainable systems were identified. These traits include good stand establishment, appropriate leaf angle, dark green color under stress (as shown by readings indicating chlorophyll content of the leaves), and synchronization of pollen shed with silk emergence under stress. Root system traits are very important to productivity under LISA systems. These traits have received very little study and have not generally been part of plant breeders' selection criteria. Therefore, they represent untapped potential for genetic improvement. We initiated development of unique genetic materials with specific adaptation to the LISA systems studied. Numerous presentations, field days, and publications documented the progress of this work. However, because funding for this project was terminated after only two years, corn varieties appropriate to sustainable agriculture were not identified.

Project ANE91-2: IMPLEMENTING AND EXTENDING LOW INPUT CRANBERRY PRODUCTION IN THE NORTHEAST

Coordinator: Anne Averill, University of Massachusetts, Department of Entomology, Fernald Hall, Amherst, MA 01003. Phone: 413-545-1054 or 508-295-2212 at Cranberry Experiment Station, East Wareham, MA 02538.

Major Participants: Frank Caruso, Carolyn DeMoranville, Karl H. Deubert, Susan Edwards, David Nolte, Mary Jane Else, Lawrence J. Dapsis, Joan R. Davenport; Charles C. Kusek and Bernard Morzuch, UMASS; Richard Andrews, Ecoscience Laboratories; Ocean Spray Cranberries, Inc.; John Decas, cranberry grower; Kirby Gilmore, cranberry grower; Douglas R. Beaton, cranberry grower; Allan W. Stretch and Nicholi Vorsa, Rutgers University Cranberry and Blueberry Research Center.

SARE Funding: $128,458. **ACE Funding:** $136,165. **Matching non-federal funds:** $229,340 This project was originally funded as LNE90-26, "Alternative Strategies for Cranberry Production in the Northeast."

Project Duration: Three years, seven months.

Project Status: Active. Two-and-a-half years have been completed.

Abstract: This project introduced low input cranberry production on a demonstration basis in Massachusetts. It involves studies of weeds, diseases, insects, and fertilizer in cranberry bogs, with an aim of reducing pesticide and fertilizer use.

The project began in 1990 on LISA cranberry bogs at four sites. A fifth location, which had been managed as an organic production site in 1990 by Ocean Spray Cranberries was added for the 1991 season. In 1992, one of the bogs was replaced with a higher-yielding bog. In 1991 and 1992, two check locations were used for water quality and productivity comparisons to the LISA bogs.

Reductions in synthetic pesticide and fertilizer inputs were substantial in the 1992 season, with no significant increases in pest damage or inadequacy in soil fertility. Over the three years of our demonstration program, synthetic insecticide applications were reduced 60 percent and fungicide applications were reduced by 28 percent in comparison to previous years. Use of EDBC fungicides and chlorothalonil (known to be highly toxic to aquatic organisms and implicated elsewhere in groundwater contamination) were reduced 66 percent in favor of copper-based, mineral fungicides (which are accepted by organic growing standards). Broadcast herbicide dose was reduced 46 percent and fertilizer nitrogen reduced by 52 percent.
Owing to the heavy utilization of surface water in cranberry bog wetlands, studies of water quality, coming into and out of the bog system, were conducted. We found that if pesticides were applied, they generally could be detected in small quantities at the bog outlet. Lowered dose of a pesticide reduced these residues. Regarding fertilizer residues, little phosphorus was detected in bog water during the growing season. Although peaks of ammonium output were observed, these were not associated with applications of fertilizer. In a number of instances, nitrogen levels at the bog outlet were lower than at the inlet, suggesting that commercial cranberry bogs may filter nutrients from incoming swamp or pond waters.

Relative to more widely grown crops, knowledge of cranberry pests is exceedingly primitive. As a result, many of our ongoing projects may appear comparatively elementary. For example, regarding cranberry weed research, studies of the destructive weed pest, dodder are continuing with the focus on predicting weed seedling emergence for the maximization of timing of pre-emergence herbicides. In addition, promising post-emergence controls (preferred when available) were field tested. Investigation of long-term costs of perennial weeds were continued. The use of a summer flood for perennial weed control was investigated. Mycoherbicide studies for bramble and dodder were conducted with little success, but pointed to future avenues of endeavor.

Regarding Cranberry disease research: Research is directed towards an in-depth evaluation of existing cranberry varieties for their resistance to field rot and storage rot. Of 45 varieties evaluated in the field, over a dozen showed field and storage rot resistance. These varieties will be utilized as parents in future crosses performed by Dr. Nicholi Vorsa, cranberry breeder at the Rutgers (NJ) Blueberry & Cranberry Research Center. These same varieties will also be evaluated for their resistance to Phytophthora root rot and upright dieback, the two major dieback diseases in most of

the cranberry-producing areas. In 1992, significant progress was made in the field establishment of variety evaluation plots.

Research directed towards a switch from the widely used chlorothalonil (a chemical which can be toxic to fish) to the more organically-acceptable copper-containing fungicides, was conclusive: The copper based fungicides cannot be the sole fungicide utilized under high rot pressure. Future rot control research will focus on the use of late water and resistant varieties, in addition to the more environmentally benign copper based fungicide. Results of the second year of spore trapping (as the first step in development of a model to forecast fruit rot) demonstrated correlations between spore release and precipitation. Spore identification and counting is ongoing with over 10,000 spores counted to date,

Regarding cranberry insect research: We have focused on biology and management of cranberry fruitworm, a pest that accounts for about 70 percent of all applications applied in IPM bogs. Cooperating pheromone chemists have made further progress in the difficult identification of the sex pheromone of cranberry fruitworm that likely will be essential as both a monitoring tool and in sex pheromone disruption of this moth. Following extensive studies to determine the egg distribution of cranberry fruitworm and subsequent development of a model to describe this distribution, a sampling plan for fruitworm has been completed that will allow confidence in the elimination of sprays based on egg counts. Studies showed that the cultural practice of holding late water is clearly an effective management tool for both cranberry fruitworm and southern red mite. Surveys completed show conclusively that indigenous natural enemies are diverse and abundant in wild bogs, but these predators and parasites are virtually eradicated under the current insecticide application regime in commercial bogs.

Regarding fertilizer research: A primary focus is to reduce movement of fertilizer out of the bog by identifying low-leaching materials. A leaching test in the laboratory showed that slow-release fertilizers, both organic and inorganic, had less leaching potential than the commonly used 12-24-12 granular soluble fertilizer. Three of the low-leaching fertilizers, composted chicken manure, fish fertilizer, and Osmocote were field tested on whole bogs with generally satisfactory results in terms of yield and fruit quality. A study to determine the suitability of low-leaching phosphorus forms for cranberry production was begun in 1992.

Project ANE91-3: USE OF THE PASTURE DISK METER TO PROMOTE WIDER USE OF CONSERVATION WINTER COVERS BY PROVIDING A RAPID METHOD OF ACCURATELY MEASURING WINTER LEGUME NITROGEN.

Coordinator: A. Morris Decker, Professor Emeritus, Agronomy Department, University of Maryland, College Park, MD 20742.
Major Participants: Andrew J. Clark, V. Allan Bandel, and Mitchell Woodward, University of Maryland; four Extension agents, nine farmers.
ACE Funding: $23,000 in 1991. **Matching non-federal funding:** $60,000.
Duration: One year.
Project Status: Final report due May 31, 1993.

Abstract: Seven commercial farmers participated in winter cover crop demonstrations for corn production systems. Some were already convinced of the value of cover crops while others were skeptical. Farmers varied widely in terms of soils, climates and types of operations. Locations ranged from the lower Coastal Plain to Piedmont Maryland.

Data collected from these demonstration plantings confirmed that most of the data collected from replicated experiments during the past ten years can be directly applied farms. For example, further confirmation of increased soil moisture use efficiency was obtained by farmers no-tilling corn into killed and living hairy vetch covers. Improved soil moisture relationships appear to help explain observed synergistic corn fertilizer nitrogen responses following legume covers. However, cover crops in these demonstrations that were plowed down appeared to mineralize more rapidly than killed mulches left of the surface and, thus, more cover crop N was available to increase corn yields. Plowing the cover down and/or allowing it to grow too long can reduce available soil moisture.

The use of cover crops complicated management strategies of cooperating producers. The most common complaint from producers was that timely cover crop seeding in the fall plus killing the cover and planting corn at the best time the following spring adds to the workload of already full farm schedules.

Data from these demonstrations have been discussed at field days and workshops. Some of the farms were included in field days and/or farm tours. As a result, many individuals were introduced, for the first time, to advantages and problems associated with the introduction of cover crops into corn production systems. Agronomy Mimeo 34, "Winter Annual Cover Crops for Maryland Corn Production Systems" can be used by interested farmers to develop systems best suited to their specific farm situation.

Project ANE91-4: EXTENSION OF THE PRE-SIDEDRESS SOIL NITRATE TEST FOR NEW JERSEY FIELD AND SWEET CORN.

Coordinator: Joseph R. Heckman, Crop Sciences Department, Rutgers University, New Brunswick, NJ 08903-0231. Phone: 908-932-9452.

Major Participants: Donald J. Prostak, Everett A. Chamberlain, William Hlubik, Robert C. Mickel, Eric P. Prostko, and John L. Gerwig, all of the Rutgers Cooperative Extension; Roger E. Wyse, New Jersey Agricultural Experiment Station; four farmers.
ACE Funding: $15,986. **Non-Federal Matching Funds:** $35,241
Duration: Two years.
Project Status: Active. One year has been completed.

Abstract: Our main objective is to extend the use of the Pre-sidedress Soil Nitrate Test (PSNT) to New Jersey field and sweet corn growers. The PSNT is an in-season soil test developed by Fred Magdoff at the University of Vermont that provides information about the nitrogen supplying capacity of a soil. PSNT results may indicate that an adequate supply of nitrogen is available in the soil to meet the needs of the corn crop or that a supplemental application of nitrogen fertilizer is required. This information helps farmers make better decisions about how much nitrogen fertilizer to use. The PSNT is most useful on manured fields where adequate nitrogen is available and nitrogen fertilizer use can be reduced substantially.

The PSNT is currently being recommended for use on field corn, but further research is needed before it can be recommended for use with sweet corn. The research and Extension activities supported by this grant, along with support provided by the New Jersey Agricultural Experiment Station, has facilitated the adoption of the PSNT by at least 30 New Jersey farmers. Experience among dairy farmers, the primary users of the PSNT, has shown that nitrogen fertilizer use can be reduced by an average of 50 pounds of nitrogen per acre while still maintaining crop yield. When nitrogen fertilizer rates can be reduced without loss of crop yield, there is a reduction in cost for fertilizer and less risk of nitrate pollution of water supplies. Total statewide savings to New Jersey farmers and the environment as a result of adoption of the PSNT are estimated at $53,000 and 177,000 pounds of nitrogen fertilizer not applied to farmland.

Project ANE91-5 ALTERNATE MANAGEMENT OF LEAFHOPPER PESTS IN INTEGRATED FARMING SYSTEMS: DEMONSTRATION OF BIOLOGICAL AND CULTURAL CONTROLS.

Coordinator: Nick Maravell, Maryland Organic Food and Farming Association, 8565 Horseshoe Lane, Potomac, MD 20854, voice (301) 983-2167, fax 301-983-0290
Major Participants: William Lamp and Galen Dively, Department of Entomology, University of Maryland; Erick Lichtenberg, Department of Agricultural and Resource Economics, University of Maryland; Michael Heller, Claggett Farm manager, Chesapeake Bay Foundation.
ACE Funding: $62,400 in 1991. **Non-federal Matching funds:** $63,750.

Duration: Two years.
Project Status: Active. One year completed.

Abstract: Farmers from the Maryland Organic Food and Farming Association initiated this project to demonstrate viable leafhopper controls for three crops important to their rotations: alfalfa, vegetable beans and potatoes.

At present, the potato leafhopper, Empoasca fabae, is a major limiting factor in large scale low-input or organic plantings of these crops. Farmers avoid these crops, use high-cost control measures, or suffer unpredictable levels of damage. Because of the highly mobile nature of the insect and its reproductive capacity, its impact during a year is difficult to predict and insecticides are currently the primary control tactic. In addition, as conventional farmers adopt alternative controls for Colorado potato beetle and Mexican bean beetle, major leafhopper resurgence as a secondary pest due to disturbance and its natural enemies has been an unanticipated consequence.

New knowledge of leafhopper natural enemies and its behavior in non-host plants has yielded biological and cultural controls as effective alternatives to chemical insecticides. We are demonstrating, in the various distinct growing regions of Maryland, two such alternative controls. One is a fungal pathogen, Zoophthora radicans, which is released by an inoculative technique in response to scouting. The other is a cultural control in which non-host grasses are combined with the leafhopper-susceptible crop as a strip crop, intercrop, or mulch.

Field trials were conducted in 1992 to determine the feasibility of controlling potato leafhopper populations primarily with a fungal pathogen and, in a few instances, with interplanting non-host vegetation. Paired plots of potatoes and snap beans were established and were sampled for leafhopper populations throughout the season. The pathogen was released at approximately half of the potato and bean sites concurrent with high populations of leafhopper. (High leafhopper populations were not present at all sites.) After the pathogen was released, dead or moribund leafhoppers were also collected, placed on water agar, and observed for development of the pathogen. The pathogen was recovered from one snap bean field. Nymph populations at this site steadily declined in both release and control plots. In the potato plots, nymph populations responded variably. Interplanting beans with grasses, vetch and corn produced no positive effects. Leafhopper populations were low this year at the alfalfa sites. In the alfalfa interplanted with grasses relatively low populations of leafhopper were observed. At this point, results are inconclusive as to the feasibility of releasing a fungal pathogen and interplanting non-host crops for control of potato leafhopper.

Project ANE91-6 Information Dissemination to Increase the Utilization of Soil-Improving Cover Crops in the Northeast Cropping Systems.

Coordinator: Marianne Sarrantonio Rodale Institute Research Center, Kutztown, PA 19530. Phone: (215) 683-6383

Major Participants: Leon Weber and Betsy Lyman, Rodale Institute Research Center; Vernon Grubinger, University of Vermont Extension Service; Tim Bowser, West Branch Bioregion Project; Steve Reiners, Rutgers University; nine cooperating farmers.

ACE Funding: $84,502. **Matching non-federal funds:** $43,881.

Duration: Two years.

Project Status: Active. One year has been completed.

Abstract: Project participants are developing and disseminating materials that will help overcome barriers to the use of cover crops in the Northeast. The work focuses on materials that will help farmers choose the most appropriate species for soil improvement for their own conditions, predict with more accuracy the likely nitrogen contribution from a green manure and asses the long-term effects of cover crops and green manures on their soil and cropping system. The products of the project will include a guide to using soil-improving crops, a database of information on soil-improving crops, on-farm demonstration trials, and workshops for educating farmers, extension personnel and others.

In 1992, Marianne Sarrantonio completed a first draft of the workbook in early September. It closely followed the outline submitted with the proposal. According to the process outlined in the original project proposal, the draft workbook was to be evaluated through a series workshops. Participants in the first workshop agreed that the book needed to be expanded to include more management information for Northeast growers, and more species-specific information. As a result, Sarrantonio rewrote Chapter 1 to include more practical information on the attributes of various species for particular purposes. Other revisions suggested by reviewers were included in the other chapters. Copies of both the first and second drafts of the workbook are available on request.

Work on the database in 1992 included the following:

- Development of the necessary software for smooth performance of the database;

- Production of the 1992 Legume Seed Source Directory, which lists seed sources for close to 400 species of legumes, as well as innoculants.

- Expanding and updating existing information on various cover crops species in preparation for publication of factsheets.

In regard to on-farm demonstrations: Twenty-four growers, representing a wide rage of farming operations, soils and climates, are participating in unreplicated screening trials of various winter cover crops. They will report back observations on their plantings in the Spring of 1993. Additionally, replicated trials were established on three different systems in Pennsylvania.

In regard to workshops: The first workshop,was held in September 1992. The 23 participants included nine extension agents, four SCS representatives, seven members of the Rodale staff and a few agricultural educators.

Project ANE91-7 Use of Composts and reduced applications of fertilizer and Herbicides to Conserve Soil and Ground Water Resources in Nurseries.

Coordinator: Richard Ashley, University of Connecticut, Storrs, CT. Phone: 203-486-3438

Major Participants: Patsy Evans, Mark Brand and Boris E. Bravo-Ureta, University of Connecticut Cooperative Extension; Lawrence L. Carville, Connecticut Nurserymen Association; Nancy DuBrule, Bill Duesing and Ellen Malona, Natural Organic Farmers Association/Connecticut; Charles R. Frink, New Haven Connecticut Agricultural Experiment Station; Susan Mulgrew, University of Massachusetts; Robert Pellegrino, Connecticut State Department of Agriculture.

ACE funding: $20,000 in 1991. **Matching non-federal funds:** $36,745.

Duration: One year.

Project Status: A no-cost extension was granted to April 30, 1993.

Project ANE92-8: DEVELOPMENT OF SUSTAINABLE CROPPING SYSTEMS FOR NEW YORK CASH CROP PRODUCERS

Primary Institution: Cornell University

Objectives:

This project will:

(1) Inform New York cash crop producers and the related agricultural industry about the need for sustainable cropping systems, and recommend economically viable cash-crop farming systems that minimize chemical inputs and maintain soil and water quality;

(2) Help New York cash crop producers develop sustainable cropping systems that increase small grain and soybean acreage and reduce corn acreage in their cropping systems;

(3) Evaluate the potential of canola as an alternative cash crop for New York cash crop producers;

(4) Identify the best sequence of crops in a sustainable cropping system for New York cash crop producers that maximizes profit and is environmentally compatible through the minimization of chemical inputs.

Project Duration: Proposed: four years. Funding is for two years.

Funding: ACE: $65,608.
Matching with non-federal funds: $81,939

Proposal:

The 1990s will pose both economic and environmental challenges for grain crop producers in the USA and New York. The chronic oversupply of feed grains and wheat, which depressed prices in the 1980s, will probably continue in the 1990s. Grain crop producers survived the 1980s because of government support programs. But the 1990 Farm Bill mandates a gradual reduction in target prices and loan rates for grain crops. Clearly, the federal government wants to move grain crop producers to a more market-oriented system.

The 1990 Farm Bill also seeks to reduce farm practices that have a negative effect on the environment. Corn, wheat, soybeans, and cotton receive 75% of government support payments; they account for 65% of agrichemical use in the USA. Recently, the Environmental Protection Agency detected nitrate in 57% and pesticides in 4% of surveyed rural drinking wells. In upstate New York, where corn is the major cash crop, nitrate and atrazine were the major contaminants found in surveyed wells. Grain crop producers must develop economically sustainable cropping systems that reduce reliance on fertilizer and pesticide inputs.

Crop rotation is the foundation of a sustainable cropping system and extension programs at land-grant universities must provide more information on this topic. Research on corn-soybean or corn-small grain/clover rotations indicates that rotated corn, which yields 10% higher than continuous corn, eliminates the need for corn rootworm insecticides and requires only 50 to 60% of the fertilizer N requirement.

Recent research also strongly suggests that annually-rotated corn is essential to the maintenance of corn yields under reduced tillage systems. Such systems are currently used on about 30 percent of the corn acreage in New York, and are expected to increase in the 1990s to comply with conservation regulations.

We propose a four-year demonstration/extension project featuring sustainable crop rotations for cash crop producers in New York. The study will demonstrate sustainable crop rotations under moldboard plow and chisel tillage systems on four cash crop operations. Nine crop rotations will be done under the two tillage systems. Annual Field Days, where cash crop producers and representatives from agricultural industry can observe sustainable cropping systems, will be held at each 10-acre demonstration site. Soil, pest and crop measurements will be taken annually at each site.

Agronomic and economic analyses will be performed annually for each site to identify the best transition crop to a sustainable cropping system, the best crop rotation and sequence of crops for a sustainable cropping system,the economic and environmental sustainability of a soybean-wheat/clover rotation and the potential of canola as an alternative cash crop for New York cash crop producers.

At the end of the 4-year project Cornell extension faculty will analyze the agronomic, economic, and environmental aspects of the data to make appropriate recommendations in Cornell Recommends for Field Crops, an annual extension publication of Cornell recommendations to New York farmers. Additionally, Surveys of the farming practices of New York cash crop producers will be taken at the beginning and the end of the project to evaluate the impact of the demonstration/extension project.

All principal investigators involved in this proposal have extension appointments and are responsible for a major portion of the recommendations in Cornell Recommends for Field Crops. Also, all principal investigators participate in numerous workshops and field days for "mainstream" New York agriculture. Our findings in the demonstration plots and subsequent recommendations are expected to have considerable impact on farming practices by New York cash croppers in the 1990s.

Major Participants:

Cornell University: William J. Cox, associate professor and department Extension leader, Dept. of Soil, Crop and Atmospheric Sciences.

Gary C. Bergstrom, associate professor and chair of the Cornell Dairy/Field Crops IPM Committee, Dept. of Plant Pathology.

Stuart K Klausner, senior Extension associate (Soil Fertility) Dept. of Soil, Crop and Atmospheric Sciences.

Elson J. Sheilds, assistant professor and department Extension leader, Dept. of Entomology.

Harold M. van Es, assistant Professor and chairman of the Cornell Agricultural Water Quality Committee, Dept. of Soil, Crop and Atmospheric Sciences.

Cornell Cooperative Extension: Nate Herendeen, Regional Field Crop Specialist, Agriculture Program Leader for Western NY.

James Capron, Regional Field Crop Specialist, Wayne County Cooperative Extension.

Judy Wright, Field Crop Cooperative Extension Agent.

Farmer Participants:

Norman Vaill, Vaill Farms, Poplar Ridge Rd.,Aurora, NY 13026.

Doug Freier, Freier Farms, 3792 Post Rd. ,Geneva, NY 14456.

Todd Roberts, Roberts Brothers Farms, 333 South Ave. Medina, NY 14103.

David Damaske, Locust Grove Farms, Victor, NY 14564

Project ANE92-9: SUSTAINABLE LANDSCAPES

Primary Institution: University of Rhode Island

Objectives:

This project will:

(1) Develop and distribute a list of sustainable landscape plants for USDA hardiness zones 5 and 6 in the northeastern US;

(2) Develop a logo, a point-of-sale tag, and user information sheets for distribution with these plants;

(3) Develop a manual on designing sustainable landscapes;

(4) Plant demonstration landscapes showing plants and practices to nurserymen, landscapers, and the general public at two educational facilities;

(5) Conduct research toward the biological control of key landscape pests including the Japanese beetle and birch leafminer.

Project Duration: Two years, beginning in the fall of 1992.

Funding: ACE: $75,000
Non-federal matching funds: $81,939

Proposal:

This project will develop and distribute information on plants and practices that contribute to sustainable landscapes - those requiring reduced inputs of pesticides, water and fertilizer.

Numerous surveys have documented the heavy use of pesticides in urban landscapes - at rates that often exceed agricultural use. Pesticide applications are often made by homeowners who are uninformed about proper use of these materials. Professionals have the proper knowledge and equipment, but their services represent a substantial expense.

None of this is necessary. Through the careful design of a landscape and proper choice and maintenance of landscape plants and materials, it is possible to largely avoid problems with pests - not only plant pests, but also many of those attacking our homes, and even ourselves.

Through a collaborative effort between commercial nurserymen and faculty from the Universities of Rhode Island Massachusetts, we'll develop and distribute a list of sustainable landscape plants for this region. This list will include trees, shrubs and groundcovers, including grasses that are adapted for various environmental conditions and landscape uses within this region. The purpose of this list is to promote production and use of low maintenance landscape plants.

We will also develop a logo, a point-of-sale tag, and user information sheets for distribution with these plants. Our goal is to enable garden shop customers, with minimal sales help, to choose plants that will require less maintenance and fit certain landscape needs.

To that end, we will also develop a manual on designing sustainable landscapes that will emphasize plant growth requirements and attempt to minimize the plant stresses that often cause pest problems. It will also contain descriptions of the plants on the sustainable list, giving such information as size, shape, shade and salt tolerance, soil and moisture requirements, etc. This manual will emphasize non-plant pests that can be managed through landscaping techniques, including many household pests (termites, carpenter ants, clover mites) and deer ticks - the Lyme disease vectors. Written for professional landscapers, but in language applicable to homeowners, it would be distributed to landscapers, nurserymen, and homeowners through Cooperative Education channels and through cooperating garden centers - particularly those in the GreenShare program.

These sustainable plants would be planted in two key horticultural educational facilities: on the URI Campus and at the U. Mass. Waltham CE Center. These showcases will provide easy evaluation and promotion of them. By holding summer meetings of the Nurserymen's Association, the American Society of Landscape Architects, and various homeowner programs such as Master Gardeners and the GreenShare Field Day at these

facilities, we'll introduce growers and customers to these plants, hopefully stimulating both production and sales.

Applied research on biological control is proposed for two key landscape pests: the birch leafminer and the Japanese beetle. The leafminer, an introduced pest, is an excellent candidate for biological control; we have established one parasitoid and we can likely establish a second with a reasonable probability of solving this problem. The Japanese beetle is arguably the most important landscape pest in this region, and along with related white grubs, represents the last stumbling block to pesticide-free lawns. A recently-discovered pathogen may have potential to control this pest complex. We'd like to evaluate this possibility.

Major Participants:

University of Rhode Island: Richard A Casagrande, professor of entomology and R.I. Extension IPM coordinator. Will serve as project coordinator, participating in all five objectives, directing research and incorporating the results of a previous LISA project he coordinated, Sustainable Sod Production.

Angelo Simeoni, landscape architect Department of Plant Sciences. Will develop the manual and participate in the development of the plant list and all other aspects of objectives.

Brian Maynard will join the Department of Plant Sciences faculty on July 1, 1992. with a teaching, research and Cooperative Extension appointment. He will participate in all aspects of objectives of this proposal.

University of Massachusetts: Roberta A. Clark, Cooperative Extension horticulture agent for the University of Massachusetts at Barnstable Mass. She has 12 years experience in observing and solving pest problems on various landscape plants and has taught and written extensively on the topic. She will be a key participant in developing the plant list, the manual, and selecting the demonstration plants for URI and Waltham.

Ken Lagerquist is now retired from managing a production nursery, garden shop, and landscaping business. He was the unanimous choice of the five nurserymen polled to see who would be the best representative- of their industry on this program. He will participate in the first four objectives and will involve other nurserymen as needed for contributions of their expertise and plant materials.

Project ANE92-10: FARMER-TO-FARMER COMPOST EXCHANGE PROJECT

Primary Institution: Hartford County Soil and Water Conservation District.

Objectives:

(1) Evaluate the use of composted municipal leaves and animal wastes as a viable nutrient management practice for dairy operations and the feasibility of dairy farms operating leaf composting facilities;

(2) Analyze two types of compost: leaf and leaf/manure compost to develop application recommendations for other farm and land use operations;

(3) Educate area farmers on the use of compost as a soil amendment, and develop a farmer-to-farmer exchange program for compost;

(4) Conduct demonstrations on three different agricultural operations. Evaluate fields - with compost applied - for crop yield changes and the potential for using compost as an best management practice for water quality protection on commercial farms;

(5) Assess the local market for composted materials and establish a network for marketing to local businesses. Other land uses may include golf courses, landscape and lawn care operations, gravel pit reclamation and landfills.

Project Duration: Two years and four months, beginning in October, 1992.

Funding: ACE: $34,000
Non-federal matching funds: $19,720

Proposal:

Both agricultural and urban communities are taking a new look at composting as it relates to waste management and disposal. In Connecticut, municipalities are asking farmers to accept municipal leaves for composting because of they have the land holdings and capabilities to do it. Farmers are becoming interested in this arrangement, and some have already entered into contracts with towns to accept leaves on a trial basis. The farmers, however, have questions about the technical and economic aspects of this practice, including

- What is the nutritive value of leaf compost and of leaves mixed with manure compost?
- What crops can it best be used on?
- Is it economic to accept leaves?
- How much can be used on my farm?
- What do I do with excess compost without an intensive marketing effort?
- With what regulations do I have to comply?
- How can this help with nutrient management?

The Hartford County Soil and Water Conservation District will coordinate a farmer-to-farmer compost exchange project that should offer answers to many of these questions.

The project will take place in northern Hartford County, an area dominated by sandy soils and large stratified drift deposits. The stratified drift aquifers in this area are used as public water supplies, and as such they are regulated under Connecticut's new Aquifer Protection Act. Farmers with operations located over the aquifers must develop resource management plans to protect ground water.

Because composted wastes slowly release nutrients, they should be ideal for use as a soil amendment on farms in the area. In this proposal, a leaf-manure composting operation on a local dairy farm in an aquifer protection area will be evaluated for use as a best management practice for animal waste and nutrient management. Additionally, a bulk distribution program for excess compost will be developed involving area farmers in need of soil amendments. Expanding bulk marketing to other land users will also be explored.

Education will be a major component of the project because it will help reintroduce compost use to commercial farming operations. The project will be coordinated by the Hartford County Soil and Water Conservation District with active involvement of area farmers and the Connecticut Agricultural Experiment Station.

Major Participants:

Hartford County Soil and Water Conservation District, Denise Conkling, district manager. The District is a quasi-state, non-profit organization set up under state statue to work on soil and water conservation issues in Connecticut. The District works closely with the USDA Soil Conservation Service and is located in the Agricultural Service Center in Hartford County, CT. Conkling will serve as project coordinator.

Connecticut Agricultural Experiment Station, Abigail Maynard, researcher.

USDA Soil Conservation Service, Eric Scherer, district conservationist.

USDA Soil Conservation and Stabilization Service, David Carey, director of Connecticut Office.

Farmer Participants:

Jack Collins , dairy farmer, Powder Hill Farm, Enfield, CT. Jack actively supports the sustainable agriculture concept. He has been a leader in the conservation field having been recognized as an outstanding farmer by the National Endowment for Soil and Water Conservation. Jack presently volunteers as chairman of the District Board of Supervisors.

Project ANE92-11: ALTERNATIVE ROTATION SYSTEM FOR VEGETABLE PRODUCTION AND SOIL CONSERVATION

Primary Institution: Farmer's Alternative Resource and Market Cooperative (FARM Coop).

Objectives:

The three main objectives of this project are to:

(1) Demonstrate a replicable, alternative soil conservation plan designed to reduce acceptable crop rotations from seven to four years per "field" for vegetable production;

(2) Reduce input costs for pesticides and herbicides in vegetable production through efficient pest monitoring, tilling, and use of alternative mulches;

(3) Develop a database for vegetable "truck-farming" that includes input, production, and marketing information, and that can be easily adapted by other small farmers;

Project Duration: Two years.

Funding: ACE: $74,131 for the two-year period.
Non-federal matching funds: $20,700

Proposal:

The area served by Penn's Corners Resource, Conservation, and Development Council represents an area with 1,484 vegetable producers, with over 5,800 acres in production. Last year, this area produced approximately $6.363 million in farm income (vegetable) cash receipts.
But new soil conservation plans could have significant economic impacts on these farmers because they reduce vegetable rotations.

In this project, alternative crop rotations, reduced tillage, alternative mulching and trickle irrigation will be used on a demonstration farm to develop a soil conservation plan for vegetable production that is acceptable to the U.S. Soil Conservation Service.

The project will utilize pest monitoring, reduced use of pesticides and herbicides and living mulches to provide a lower input, sustainable approach for growing sweet peppers,

sweet corn and pumpkins on the Matthews family farm. It will compare production costs, soil erosion, and marketability between the alternative approach and more conventional methods.

The cooperators intend to demonstrate the use of low input methods rather than methods regularly used throughout the northern Appalachia region. Through presentations at grower's meetings, extension activities, information services of cooperators, and field days, the summarized findings will be shared in a manner that facilitates replication. The project is expected to conclude at the end of the 1995 growing season, although funding is requested only for 1993 and 1994.

An essential component of this project is the actual monitoring of soil loss as a confirmation of the extent of difference in soil conservation between the various comparison fields. Representatives of the Cooperative Extension Service, Soil Conservation Service U.S.D.A.), Agricultural Stabilization and Conservation Services (U.S.D.A.),and the local Washington County Conservation District will work with the Matthews family farm to develop, implement, and distribute results from this project.

Comparison fields of similar slope, soil type, and directional exposure will be established. Two fields each of sweet peppers, pumpkins, and sweet corn will be monitored. The low-input fields will utilize narrower strips of vegetables separated by more frequent strips of sod than the 80 ft. control strips. In addition, low-input pumpkins will be no-till planted. Trickle irrigation, pest monitoring, and a live green mulch, such as hairy vetch or rye, will also be used. Comparison fields will use more traditional field preparation, extension service's recommended use of pesticides and herbicides, and "sprinklertype" irrigation. If funded, two additional farmers will be sought to help replicate key aspects of this project.

This demonstration project proposal is being written and developed by the actual farmers who intend to implement the ideas. Participants requesting funds include representatives of the Farmer's Alternative Resources and Marketing Cooperative (F.A.R.M. Coop), a non-profit organization, and Penn's Corners Resource Conservation and Development Charitable Trust (Penn's Corners). Other cooperating organizations include local representatives of the Soil Conservation Service, U.S.D.A., Washington County Conservation District, Penn State Co-operative Extension Service, and the Agricultural Stabilization and Conservation Service.

Major Participants:

Allen G. Matthews, farmer and project coordinator. Box 84, Scenery Hill, PA 15360. Manager of Farmer's Alternative Resource and Market Cooperative, (FARM Coop).

Penn State Cooperative Extension Service: Edward J. Woods, Washington County Extension director. Generated ideas, will help evaluate project and disseminate results.

Washington County Agricultural Stabilization and Conservation Service: Robert K. Lusk, executive director. Generated ideas, will cost share efforts, evaluate project and distribute results.

Soil Conservation Service: Thomas P. Sierzega Jr. and Kenneth Kearns, district conservationists. Will help manage and monitor project, provide information, evaluation soil conservation plan and distribute results.

Farmer Participants:

Harvey G. Matthews, farmer, land owner. Helped generate ideas, will provide information on yields and costs, provided land for project, will participate in all aspects of project.

John H. Matthews, farmer. Key generator of ideas, primary provider of data, provided all plant and soil preparation through harvest.

Project ANE92-12: ECOSYSTEM-BASED ORCHARD MANAGEMENT FOR PROCESSING APPLES

(4/14/93)

Primary Institution: West Virginia University

Objectives:

The objectives described below relate to research and extension activities that will be conducted during the funding period. This study will be part of a larger, long-term project evaluating alternative management systems for processing apples.

This project will:

(1) Test the hypothesis that nutrient and ground cover management programs affect nitrogen mineralization, nitrification, and nitrate mobility in conventional versus killed sod soil management systems;

(2) Quantify development of pest and biocontrol agent populations in conventional and killed sod soil management systems;

(3) Quantify nitrogen and pesticide inputs, tree growth, and economic benefits during the preplant and orchard establishment phase to provide whole orchard system data on these orchard management alternatives;

(4) Increase dissemination to growers and industry acceptance of ecosystem-based systems.

Project Duration: This study is part of a larger, long-term project. The grant will fund research objectives 1 through 4 for one year.

Funding: ACE: $16,200
Non-federal matching funds: $15,298

1993 ACE Grant Amount: $50,670 (funding for three years). Non-federal matching funds: $47,894. Other federal funds: $27,636.

Proposal:

Researchers will continue testing sustainable orchard practices against conventional systems on a 14 acre orchard at the West Virginia Experiment Station. The focus will be on soil management, nematode control, tree establishment and economic analysis.

West Virginia has approximately 15,300 acres of apples currently in production. In the combined Mid-Atlantic region of Pennsylvania, Virginia, West Virginia, and Maryland, apples are grown on 70,000 acres and command a market worth of about $124.3 million annually. Apples for the processing market account for 50% to 60% of the total production.

Because processing apples can be marketed with higher levels of insect and disease injury than would be acceptable for fresh market fruit, reductions in pesticide and fertilizer inputs can be a realistic management recommendation that could have substantial positive impacts on the environment and risks to human health. Integrated whole farm management systems offer the potential to reduce impacts on the environment and human health while increasing net income to the fruit industry.

This project will conduct a unique, comprehensive evaluation of ecosystem-based, long-term management systems for processing apples on a whole-orchard scale. The early focus will be on soil management, nematode control and tree establishment, with the objective of filling the allotted growing space in the test orchard and bringing the trees into production within three years. The research focus subsequent years will be to evaluate disease and pest control tactics that minimize pesticide inputs.

A 14 acre orchard is being established at the West Virginia University Experiment Station, in Kearneysville, WV, The site has been divided into six two-acre main plots with each plot randomly assigned one of two treatments - either conventional production practices

or ecosystem-based practices. Whole-farm economic analyses will be conducted on the two systems, and budgets will be developed for presentation to fruit growers and processors.

Second stage testing will occur in grower orchards in conjunction with an existing integrated orchard management (IOM) program (co-sponsored by ASCS and WVU). Orchardists will be encouraged to integrate new ecosystem-based approaches into their operations through a regional IOM bulletin, scout training workshops, field days and the WVU Orchard Monitor, a biweekly newsletter.

Justification:

1. Maximizing tree growth to bring the orchard into full production as quickly as possible has historically been achieved through high levels of chemical inputs. Soil management systems that more efficiently utilize available inputs would allow optimum tree growth, but could reduce leaching.

2. Differences in activity and population density of nematode biocontrol agents between the ecosystem-based and conventional treatments will provide data for evaluating the long-term sustainability of different management systems for soilborne pests.

3. It is our hypothesis, based on previous observations, that the soil management system is as important as the amount of fertilizer inputs in determining tree growth. Budgets of nitrogen, nematicide and herbicide inputs will be presented to fruit growers.

4. Cost-effectiveness analyses will be used to help growers and processors assess how best to achieve optimum productivity concomitant with increased environmental protection. Information gained from the ecosystem-based demonstration will be presented to fruit growers through workshops and publications. Since West Virginia University has a strong IOM program in place, it is anticipated that new integrated practices will be readily implemented by the northeastern fruit industry.

Major Participants:

West Virginia University: Tara A. Baugher, Extension specialist--horticulture. Will serve as co-chairperson of committee responsible for the project in addition to conducting horticultural research and extension activities.

James B. Kotcon, nematologist. Will serve as co-chairperson of committee responsible for the project as well as assess nematode population densities and nematode biocontrol activities.

Alan J. Sexstone, environmental microbiologist. Will provide expertise on nitrogen and pesticide assays, some of which may be conducted in outside laboratories.

Henry W. Hogmire, Jr., Extension specialist-- entomology. Will monitor insects and, as IOM project leader, will organize scout training workshop and writing of IOM bulletin.

Alan R. Biggs, Extension specialist-- plant pathology, Will monitor diseases and assist with Extension activities. Alan Collins, agricultural economist, Will conduct whole farm management analyses.

USDA Appalachian Fruit Research Station: D. Michael Glenn, soil scientist, Will provide leadership for orchard floor management studies. Gary Lightner, computer specialist, Will develop decision-making computer software.

Jefferson County ASCS: Michael P. Sienkiewicz, director. Plans to assist with second stage testing of ecosystem-based management strategies (in grower orchards).

Farmer Participants:

Ron Slonaker, grower and president, WV State Horticultural Society, Kearneysville, WV. Will co-sponsor orchard field days and generate ideas for extension programs. Also is an ASCS/Extension IOM cooperator.

Charles Cottrill, Jr., grower and chairman, WV State Horticultural Society Extension Advisory Committee, Hedgesville, WV. Has generated ideas for this project and will assist with project evaluation and educational programs.

Michael Orr, grower and member, WV State Horticultural Society Extension Advisory Committee, Martinsburg, WV. Has generated ideas for this project and will assist with project evaluation and educational programs.

Processors:

Ward Cooper, Knouse Foods Cooperative, Peach Glen, PA. Has agreed to generate ideas for project and provide cost information.

William Huehn, Processor, National Fruit Product Co., Winchester, VA. Has agreed to generate ideas for project and provide cost information.

Merl Orebaugh, Processor, Bowman Apple Products, Mt. Jackson, VA. Has agreed to generate ideas for project and provide cost information.

West Virginia Department of Agriculture: Ray Barber, Director, Laboratory Services Division, Will analyze samples for pesticide residues (for minimal cost).

Others:

Pennsylvania State University: Edward Rajotte, Extension specialist--entomology. Plans to assist with regional IOM bulletin and provide suggestions on preparing enterprise budgets that can be adapted to Expert programs.

Doug Pfeiffer, Extension Specialist--Entomology, VPI and SU. Will assist with regional IOM bulletin.

University of Maryland, Galen Dively, IPM specialist. Will assist with regional IOM bulletin and scout training workshops.

Project ANE92-13: DEVELOPMENT, DEMONSTRATION, AND IMPLEMENTATION OF A LOW INPUT, SUSTAINABLE POTATO INTEGRATED CROP MANAGEMENT PROGRAM

Primary Institution: The Pennsylvania State University

Objectives:

(1) To conduct an on-farm demonstration and test of a low input sustainable potato ICM system;

(2) To evaluate in the laboratory and field test an entomopathogenic nematode and mulch agrosystem for Colorado potato beetle bio-control;

(3) To develop and deliver, with grower involvement, a low input sustainable potato ICM program on commercial farms.

Project Duration: September 1, 1992 through August 31, 1993.

Funding: ACE: $25,000
Non-federal matching funds: $25,734

Proposal:

Current potato production practices rely heavily on numerous applications of highly toxic pesticides. For commercial potato production to remain a viable enterprise, a low input, sustainable, crop management (ICM) program must be developed, shown to be economically feasible and then broadly implemented.

We have developed a prototype system for low input sustainable potato ICM. This system will be demonstrated on a commercial farm where numerous low input practices will be integrated and evaluated against traditional methods in a full series of rotations. This demonstration will be included in Penn. State's Ag Progress Days Exposition to insure wide grower and public participation.

The ICM system will be expanded with the development of a Colorado potato beetle (CPB) biological control agent. We will develop a potato agrosystem conducive to the survival of entomopathogenic nematodes, and evaluate it's potential for CPB control. This system, utilizing mulches to promote Steinernematid survival will target CPB fourth instars, pupae and emerging adults. It could potentially replace mid-season insecticides while improving crop yields and soil fertility.

In addition to being effective, a low input potato ICM program must be easily implemented and available for daily use. To this end, the ICM program will be evaluated by growers on at least five commercial farms. Potato fields on these farms will be scouted weekly and the growers' presented with low input pest management recommendations. Their responses will be evaluated and used to make improvements. Finally, the ICM program will be made publicly available. An expert system will be targeted toward county extension of offices and scientists. A "paper based system" will be developed, published in the regional spray guides, and targeted toward the majority of growers.

In conclusion, this project will further develop and demonstrate a low input sustainable potato ICM program. Furthermore, a biocontrol system for CPB will be developed and field tested. The entire ICM program will be made available for wide scale implementation through public demonstrations, on farm recommendations, the delivery of an expert system to extension offices, and the publication of a paper based method for inexpensive daily on farm implementation.

Major Participants:

The Pennsylvania State University: Zane Smilowitz, Professor of Entomology, Department of Entomology. Project coordinator, will oversee research programs and coordinate extension effort with county extension agents.

M. C. Saunders, Associate Professor of Entomology, Department of Entomology, Will oversee research on entomopathogenic nematodes and development and implementation of PotatoES;

B. J. Christ, Associate Professor of Plant Pathology, Department of Plant Pathology, Will oversee pathology aspects of the program and PotatoES and research on Verticillium and phytopathogenic nematodes.

R. Weisz, Research Scientist, Department of Entomology.Plant physiologist, biological systems science, 100% research. Responsible for development of PotatoES and field experiments on the research farm and on Roy Campbell's potato farm in Centre County.

R F. Leiby, Extension Director Lehigh and Northampton Counties, Agronomy and Extension Education. Responsible for advising and coordinating extension aspects of the programs. Supervising scouts and working as liaison between farmers and researchers in eastern Pennsylvania.

BIOSYS: A Biological Pest Control Company. 1057 East Meadow Circle, Palo Alto, CA 94303. Biosys will support this research by providing entomopathogenic nematodes required for development of a CPB biocontrol agrosystem.

Farmer Participants:

Roy J. Campbell. Farmer, Pennsylvania Furnace, Pennsylvania. Mr. Campbell has consented to have replicated experiments and demonstrations conducted on his potato farm. He will plant, spray, harvest and maintain potatoes and other crops. He will also provide economic information required for development of enterprise budgets.

Walter F. Frisch. Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Frisch will participate in evaluating the ICM program on his farm.

Garry Hunsicher, Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Hunsicher will participate in evaluating the ICM program on his farm.

Mark A. Lichtwalner, Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Lichtwalner will participate in evaluating the ICM program on his farm.

George L. Billig, Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Billig will participate in evaluating the ICM program on his farm.

Willard A. Kistler, Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Kistler will participate in evaluating the ICM program on his farm.

Sherwood Geiger, Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Geiger will participate in evaluating the ICM program on his farm.

Robert Schmitt, Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Schmitt will participate in evaluating the ICM program on his farm.

Keith E. Masser, Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Masser will participate in evaluating the ICM program on his farm.

John Herwilliger, Lehigh County, Pennsylvania has consented to have unreplicated experiments conducted on his potato farm. Mr. Herwilliger will participate in evaluating the ICM program on his farm.

Project ANE92-14: INTEGRATED KENAF, BROILER MANURE AND BEEF PRODUCTION SYSTEMS

Primary Institution: University of Delaware

Objectives:

This project will

(1) Promote the use of broiler manure as a feed ingredient and pasture fertilizer with beef producers;

(2) Demonstrate the use of broiler manure as a fertilizer for beef pasture and measure its effect on groundwater quality;

(3) Demonstrate the value of broiler manure as a low-cost feed ingredient for beef animals;

(4) Demonstrate that kenaf can be grown and used on the farm as poultry litter and determine the cost of production;

(5) Compare the value of kenaf broiler litter with sawdust broiler litter as a beef feed ingredient;

(6) Compare the quality of kenaf and sawdust litter - broiler nutrient sink and plant nutrient source;

(7) Develop an integrated kenaf/broiler/beef farm production system for Delmarva.

Project Duration: Two years, beginning Feb. 1993

Funding: ACE: $81,500
Matching with non-fedral funds: $69,259

Proposal:

This two year educational project will use demonstrations, field days and newsletters to promote the use of a waste - broiler chicken manure - as an abundant and inexpensive source of feed and pasture fertilizer for beef production.

Broiler production is heavily concentrated on the Delmarva peninsula, with over 500 million chickens produced annually. Delmarva is the area between the Atlantic Ocean and Delaware Bay and the Chesapeake Bay that is part of the states of Delaware, Maryland and Virginia.

In Delaware, broiler production is concentrated in the southern portion of the state, an area that has sandy soils and high water tables. Over 230 million broilers are grown yearly in this region. They produce over 260,000 tons of manure annually, which contains nearly 16 million pounds of nitrogen. Some of this nitrogen ends up in groundwater. The nitrate concentration in the water table aquifer is increasing where broiler production is concentrated.

Methods of preventing nitrate leaching from agricultural sources must be found to protect groundwater. The beef industry could utilize part of this broiler manure as a feed ingredient and as a pasture fertilizer.

In this project, kenaf, will be grown and used on the farm for boiler litter as a substitute for sawdust and its beef feeding value determined. Beef producers, consumers and others will be able to sample broiler manure fed beef at a field day at the conclusion of the feeding trial.

In this project, farmers will be shown that broiler manure can be used to fertilize pastures just as effectively as chemical fertilizers and when applied at low rates at the proper time, it will not degrade groundwater quality or be detrimental to beef animal health. Also, plan to show that manure can lower costs while improving pasture production.

The quality of kenaf and sawdust based litter-broiler manure as a plant nutrient sink and fertilizer source will be compared in a laboratory study. An integrated kenaf/broiler/beef farm production system will be developed that will lower production costs while protecting groundwater quality from excess nitrate from broiler manure.

Continual expansion of the broiler industry (about five percent per year) has created an increased demand for sawdust and shavings as poultry litter. Costs have risen, and supply has been variable. As a result, broiler producers are cleaning out growing houses less frequently and broiler mortality has risen to over eight percent. Preliminary tests have shown that

chopped kenaf could be used as an alternative litter material. Growing kenaf and using it for poultry litter could reduce litter costs and encourage more frequent manure removal.

Preliminary tests have shown that kenaf based broiler manure is more digestible in the rumen then sawdust based broiler manure. This needs to be investigated further to support the use of kenaf as a poultry litter.

Beef producers will be surveyed at the beginning and end of the project to determine the extent of broiler manure usage in beef production, impediments to usage and intent to change practices.

Major Participants:

University of Delaware, College of Agricultural Science: Thomas Williams, Extension specialist in agricultural engineering. Specializes in machinery and irrigation management, tillage and water quality. Extension water quality program leader. Mr. Williams will be involved in all phases of the project as coordinator, including leading integrated system design team and writing reports.

Richard A. Barczewski, Ph.D. Extension specialist in livestock production, will promote the use of broiler manure in beef production through newsletters, field days and beef producer surveys.

Conrado M. Gempesaw, Ph.D. Associate Professor, Department of Food and Resource Economics. Specializes in farm management and production economics. Dr.Gempesaw will help determine costs of production and enterprise budgets, as well as assisting with the integrated system design and the beef producer survey.

Limin Kung, Jr., Ph.D. Assistant Professor, Department of Animal Science and Agricultural Biochemistry. Dr. Kung will help determine feed rations as well as assist with field days and newsletters.

William F. Ritter, Ph.D. Professor, Department of Agricultural Engineering. Specializes in water quality, waste utilization, non-point source pollution and irrigation management. Dr. Ritter will help install, sample and analyze pasture monitoring wells. He will also assist in designing the integrated system.

James Thomas Sims, Ph.D. Associate Professor, Department of Plant and Soil Sciences. Specializes in soil chemistry, soil fertility, manure and other organic sources of plant nutrients. Dr. Sims will direct laboratory study on the quality of kenaf and sawdust litters as plant nutrient sources and sinks.

Richard W. Taylor, Ph.D. Extension specialist in soil fertility and crop management. Dr. Taylor will be involved in the pasture fertilization work and the growing of kenaf.

Edward R. Jones, Ph.D. Professor, Department of Agriculture and Natural Resources. Specializes in beef pasture production systems.Dr. Jones will conduct the feeding trials, measure pasture production and assist with the system design.

Farmer Participants:

Donnell Calhoun. Milford, DE. Farms 1500 partially irrigated acres growing grain and vegetable crops. Produces broilers and beef Mr. Calhoun will provide 10 acres of pasture, broiler manure and fertilizer, two acres acres to grow kenaf, and the broiler house to use the kenaf litter. He will share his experiences with other producers at the field day and pasture meetings and help determine production costs.

Project ANE92-15: FUNGAL PATHOGENS FOR BIOCONTROL OF SWEETPOTATO WHITEFLY IN GREENHOUSES

Primary Institution: University of Vermont

Objectives:

This project will:

(1) Determine the pathogenicity of selected fungal strains to the sweetpotato whitefly;

(2) Determine the relative susceptibility of different whitefly development stages to effective fungal strains identified in Objective 1.

Project Duration: October 1992 through September 30, 1994
Funding: ACE: $68,561
Total matching funds: $75,314.

Proposal:

The sweetpotato whitefly, Bemisia tabaci (SPWF), is a major new pest of northern greenhouse crops. With a reported host range of over 400 plants and an ability to transmit over 60 plant viruses, this pest poses a serious threat to the greenhouse industry.

Control with conventional techniques is difficult because of the natural tolerance of SPWF egg and pupal stages to most chemical pesticides and the rapid development of insecticide resistance. Production and distribution of plants by large-scale propagators using

intensive spray regimes significantly contributes to the development and spread of insecticide-resistant strains of SPWF.

New management approaches are needed. We have recovered a variety of entomogenous fungi from diverse source materials collected in Vermont. The pathogenicity of a number of these indigenous isolates to western flower thrips (WFT) has already been demonstrated. Our objectives are to conduct pathogenicity tests against SPWF using a range of WFT-active strains of Verticilium lecanii, Beauveria bassiana, Metarhizium anisopliae and Paecilomyces farinosus. Active strains will then be evaluated against different SPWF developmental stages. By using a broad base of strain types we will be able to identify the most active strains for use against SPWF.

Knowing the relative susceptibility of the different SPWF developmental stages to a selection of fungal pathogens, we will be able to establish which stage can most effectively be targeted with a fungal treatment, the spore dose required, and whether one fungal isolate could, potentially, be used to control all stages. By initially selecting strains that exhibit toxicity to WFT we will also be able to show which of the fungal isolates have the greatest promise for use against other pest species, making them a more cost-effective and attractive proposition for commercial greenhouse use.

Major Participants:

University of Vermont: Bruce L. Parker Ph.D.., professor of entomology, and Michael Brownbridge, Ph.D.., research assistant professor and insect pathologist, co-investigators. Also: Margaret Skinner, M.S. laboratory and field technician; John P. Hayden, M.S., research technician; Donald L. McLean, entomology professor; Leonard Perry, Ph.D.., extension horticulturist and greenhouse specialist;

Cornell University: Gerard Ferrentino, M.S., specialist in greenhouse IPM; John P. Sanderson, Ph.D., IPM greenhouse specialist. Jennifer A. Grant, greenhouse Extension specialist, Geneva Experiment Station.

USDA-ARS: Richard A. Humber, Ph.D., specialist in taxonomy of insect fungi.

Adrian T. Gillespie, Ph.D., insect pathologist for Chr. Hansen's Biosystems, Denmark, a commercial producer of Verticillium lecanii in Europe.

Grower Participants:

David G. Marshall, greenhouse manager, Mailloux Greenhouses Inc., Ferrisburgh, VT.

Chris Conant and Thomas J. Doubleday, Claussen's Florist and Greenhouse, Colchester, Vermont.

Project ACE92-16: DEVELOPMENT OF A SUSTAINABLE APPLE PRODUCTION SYSTEM FOR THE NORTHEAST.

Project Coordinator: Terry Schettini, Rodale Institute, Pennsylvania.

Using disease-resistant cultivars and integrated pest management techniques, researchers will continue developing sustainable apple production systems in five Northeast state.

Participants: Rodale Institute, Rutgers University, University of Massachusetts, University of Vermont, Cornell University and apple growers in the five states.

1993 SARE Grant Amount: $97,800 for one year.
1993 ACE Grant Amount: $164,200 for one year. Matching:

Project ANE93-17: IMPROVING NUTRIENT MANAGEMENT ON A 100-COW FREE STALL DAIRY FARM

Primary Institute: W.H. Miner Agricultural Research Institute

Objectives:

1. Contuct a detailed evaluation of the nutrient balance on the 100-cow Miner Institute dairy farm, and compare it to the average New York dairy farm.

2. Improve existing models to predict the flow of N, P, and K through the cow, manure storage, and to the field.

3. Evaluate the effects on the farm nutrient balance of phosphorus by the substitution of manure for commercial fertilizer for established alfalfa.

4. Evaluate the effects on the farm nutrient galance of nitrogen by the use of pre-sidedress nitrogen tests.

Project Duration: Three years. February 1, 1994 - January 31, 1997

Funding: ACE: $97,000 for three years.
Matching non-federal: $24,507.

Proposal:

Participants will investigate potential alternatives for reducing the amount of nutrients that accumulate on dairy farms, looking at both plant and animal systems. It includes dairy nutrition research to explore techniques to increase digestibility and utilization of forage and grain. and better balance supply and demand of N, P, and K.

Dairy farmers make inefficient use of nutrients entering the farm as fertilize4, feed, and minerals, partly due to the fact that ruminants such as dairy cattle only utilize a small proportion of what they consume. Increased concentrations of animals and greater distances from farmstead to fields pose particular challenges for moderately large farms.

This proposal would investigate avenues that have the potential of reducing the amount of nutrients accumulating on dairy farms. Both animal and plant systems would be involved, using the 100-cow,360-crop acre dairy farm at Miner Institute. Dairy nutrition research would explore innovative techniques to increase digestibility and utilization of forage and grain. Dairy manure would replace commercial fertilizer on established alfalfa, and pre-sidedress nitrogen tests would direct N use on corn. The entire feed and mineral program would be evaluated, and the research staff at the appropriate mineral and grain companies would be involved in the effort to better balance supply and demand of N, P, and K.

The result of these efforts would be a decrease of nutrients purchased for use on the farm, and increased efficiency of the nutrients fed to dairy cattle.

Major Participants:

W.H. Miner Agricultural Research Institute: Everett D. Thomas, (Project Coordinator), P.O. Box 90, Chazy, NY 12921, Phone (518) 846-8020 FAX: (518) 846-8445. Will conduct nutrient cycling project and evaluation of nutrient reduction plan for field crops including manure management ant PSNT.

W.H. Miner Agricultural Research Institute: Charles J. Sniffen, dairy scientist. Will conduct dairy feeding research trial which will evaluated economic and production effects of reduced dietary inputs of N, P, and K, and validation of the model.

Cargill, Inc.: Steven I. Smith, research dairy nutritionist, Cargill Research Farm, 10383 165th Ave. NW, Box 301, Elk River, MN 55330. Will assist in dairy feeding research trial, particularly those aspects which involve actions the feed industry can take to increase the efficiency of NPK utilization such as substitution on mineral sources.

University of Pennsylvania: William V. Chalupa, rumnant nutritionist. School of Veterinary Medicine, New Bolton Center, 382 West Street Road, Kennett Square, PA 19348-1692. Will assist in dairy feeding research trial, particularly those aspects dealing with protein utilization.

Project ANE93-18[5]: ECOLOGICAL MANAGEMENT OF POTATO CROPPING SYSTEMS

Primary Institution: University of Maine

Objectives:

1. Determine the effects of green manure, compost and manure use on soil physical properties, nitrate leaching, and potato plant growth, water status and yield.

2. Determine the impact of two microbial pathogens (*Bacillus thuringiensis* and *Beauveria bassiana*) and two insect predators (*Perillus bioculatus* and *Coleomegilla maculata*), singularly and in combination, on mortality of Colorado potato beetle. Results will be used to develop a multi-tactic biological control program for Colorado potato beetle.

Project Duration: Two years as LNE93-36; and two years as ACE93-18.

Funding: ACE: $38,130 for two years.
Non-federal matching funds: $69,000. **(SARE and ACE combined)**
Other federal funds: $377,971. **(SARE and ACE combined)**

Proposal:

This project is part of a larger, interdisciplinary "Potato Agroecosystem" project. SARE/ACE funds will be used to investigate the effects of green manure, compost and manure soil physical properties, and to determine the impact of four biocontrol agents on Colorado potato beetles.
Participants: University of Maine, USDA-ARS New England Plant, Soil & Water Laboratory.

Potato production in the Northeast is frequently chemical intensive and often promotes degradation of soil resources due to intensive cultivation and short cropping cycles. The intensity of chemical use associated with conventional potato production raises questions regarding potential environmental effects and long-term sustainability given increasing concerns about agriculture's impact upon ground and surface water quality, worker safety,

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[5] This project ANE93-18 will receive $38,130 of ACE Funds for two years; and as LNE93-36 it will receive $111,870 of SARE Funds for two years. Total Non-federal matching funds $69,000, and Other federal matching funds: $377,971 have not been separated into SARE and ACE amounts yet.

food quality, wildlife and fisheries. Soil erosion and loss of organic matter and aggregation can limit productivity of potato soils. Long-term acreage and production trends for potatoes in Maine and the Northeast indicate that new production approaches are needed to improve soil productivity and to retain a sustainable Northeast potato industry.

In this proposal, we request funds for a research project focusing on ecological soil and pest management strategies for potato cropping systems. Funds will be used to enhance the University of Maines's interdisciplinary "Potato Agroecosystem" research project with particular emphasis on expanding the scope of our investigations of soil physical properties and insect biocontrol. Specifically, effects of organic soil amendments on soil physical properties and water holding will be studied with the goal of identifying alternatives to supplemental irrigation while reducing nitrate leaching losses. A multifaceted strategy for biological control of the Colorado potato beetle (CPB) will be examined. The research involved in this proposal is restricted to experiment station plots because it involves, in many cases, significant alterations of conventional potato production practices. The proposal addresses SARE FY'93 priority areas including: 1) protection of water quality; 2) analysis of economic costs and returns of alterantive management systems; and 3) studies of natural systems, including soil management effects on soil properties, nutrient dynamics, crop responses to alternative management strategies and biocontrol measures. Results of this project will help develop production systems that better maintain or improve soil productivity, and more efficiently control CPB, with reduced reliance upon purchased fertilizers and pesticides.

Major Participants:

University of Maine: Gregory A. Porter (Project Coordinator), Department of Plant, Soil & Environmental Sciences, 5722 Deeting Hall, Orono, ME 04469-5722, Phone (207) 581-2943; FAX: (207) 581-2999. He will supervise crop establishment, crop growth and physiological measurements, and plot harvest. He will be a secondary supervisor of the Scientific Technician and supervise some of the soil analyses. He will report results on crop responses and their relationship to soil physical properties.

C. Wayne Honeycutt, Soil Scientist & Faculty Associate, USDA-ARS, New England Plant, Soil, & Water Lab., University of Maine. He will direct a graduate student in the conduct of the studies below.

An unnamed graduate student will assist in conducting these studies.

M. Naguib Bedaiwy, Dept. of Plant, Soil & Environmental Sciences, Will conduct most of the soil sampling and analyses of soil physical properties and moisture content. He will be primary supervisor of the Scientific Technician and responsible for operation of the irrigation system. He will report results on soil physical properties.

Jefferey C. McBurnie, Dept. of BioResource Engineering, will conduct soil solution sampling and analyses. He will assist in irrigation system operation, soil sampling and will be a secondary supervisor of the Scientific Technician. He will report results on soil solution nitrate levels and adaptation of the two leaching models.

E. Groden, Dept. of Entomology, is employed as a 50% appointment and so she has budgeted for one month summer salary.

F.A. Drummond, Dept. of Entomology, is employed as a 50% appointment and so he has budgeted for one month summer salary.

M.C. Marra, Dept. of agricultural and Resource Economics, will work with Drummond and Groden.

PART IV. FARMER/GROWER INITIATED GRANTS FUNDED IN 1993

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Brief Descripitons of the Projects Funded:

FNE93-1: "Transplanting Cole Crops in Rye/Vetch Sod," Erroll A. Mattox, Three Maples Farm, Rte. 1 Box 16, Hebron, MD 21830. Funding: $360 Mattox will evaluate the nitrogen availability and weed suppression capability of a rye/vetch cover crop for use with fall kale and collard production.

FNE93-2: "The Use of Rotational Grazing in the Production of Lambs for the Hothouse Market," Richard Leverett, RD2 Box 308, St. Johnsville, NY 13452. Funding: $2,250. Leverett will compare the growth rate of lambs on ewes grazed on intensive rotational pasture to the growth of lambs raised on ewes fed a silage/grain. One goal of the project is to demonstrate lower-cost alternatives to confinement feeding.

FNE93-3: "Integrated Crop Management for Greenhouse Bedding Plants with Emphasis on Biological Control," Don Ziegler, Corn Crib, Boardman Street, Sheffield, MA 01257. Funding: $1,199 Ziegler will demonstrate an innovative, integrated approach to pest management for greenhouse bedding plants. The project is aimed at reducing pesticide use to cut production costs and reduce health risks for greenhouse workers

FNE93-4: "Evaluation of Five Organic Techniques on Controlling Flea Beetles on Kennebec Potatoes," Myra Bonhage-Hale, La Paix Farm, HC 64 Box 17, Alum Bridge, WV 26321. Funding: $755. Bonhage-Hale will compare the effectiveness of five organic techniques of controlling flea beetles on potato plants. The project is aimed at demonstrating non-chemical pest controls and raising farmer awareness of non-toxic methods of controlling flea beetles.

FNE93-5: "The Evaluation of Different Rates of Compost Produced by the Lubke Method on Soybean Yields and the Soil," David & Brenda Gaither, 8502-A Woodville Rd, Mt. Airy, MD 21771. Funding: $2,100. The Gaithers will evaluate application rates of compost produced by the Lubke method for soybean production..They plan to produce the compost on their dairy farm and test three different application rates. The project is aimed at understanding how compost can enhance soil productivity and farm profitability.

FNE93-6: "Development and Evaluation of an Alternative Ice House Refrigeration System," Charlie Chase, 124 Hall Rd, Green, RI 02827. Funding: $1,500. Chase will develop a working model of an environmentally safe, economical refrigerator. He will use ice formed inside a well-insulated room in the winter for cold storage of spring and summer fruits and vegetables, and evaluate its effectiveness in reducing labor, production costs and ability to extend the market calendar.

FNE93-7: "Ginseng Production Project," Van and Edna Wysong, P.O. Box 476, Matoaka, WV 24736. Funding: $1,750. The Wysongs, will conduct a pilot ginseng growing project. The

project is aimed at determining the feasibility of growing ginseng as a cash crop for additional income for Appalachian farmers.

FNE93-8: "Flame Weed Control in Cut Flower Production," Paul Pieri, Maurolou Farm, P. O. Box 919, Little Compton, RI 02837. Funding: $1,350. Pieri will design and construct a hand cart-type flame weeding tool suitable for small scale use and farm trials. The tool will be tested on a variety of field grown cut flowers, planted in both beds and rows. The project attempts to address the high cost and difficulty of weed control in field grown cut flowers. At the conclusion of the project, the flamer will be turned over to and become the property of the Rhode Island Sustainable Agriculture Committee for farmer loan, farm demonstrations or further trials.

FNE93-9: "Evaluation of the Economic and Environmental Impact of Amino Acid Based Laying Rations," Charles Wallace, P. O. Box 298, Turkey Lane Road, Winthrop, ME 04364. Funding: $660. Wallace will evaluate the impact of amino acid-based layer rations on the performance of layer hens, nitrogen content of chicken manure and feed costs. Wallace's project is aimed at reducing environmental impacts and improving farm profitability by cutting feed costs and the nitrogen content of manure.

FNE93-10: "Nutrient Management For Potatoes Used for Potato Chips," Carl D. Smith, RR1 Box 1335, Corinna, ME 04928. Funding: $5,000. Smith will collaborate with five other potato growers to quantify the factors that affect color and composition of potatoes grown for chips. The project is aimed at achieving better understanding of the factors -- nutrients, soil types, climatic conditions and potato varieties -- that affect the characteristics required in potatoes by chip processors.

FNE93-11: "Evaluation of a Fiber Flax Production System as a Low Input, Alternative Crop for Northern New England," Greg Ward, RR#1 Box 17, Limestone, ME 04750. Funding: $5,000. Ward will demonstrate fiber flax production by testing two disease-resistant varieties and harvest machinery from France. Ward's project is aimed at testing a possible alternative crop to diversify farm income.

FNE93-12: "Bio-Control of Corn Earworm and European Corn Borer in Sweet Corn," Nicholas C. Maravell, Nick's Organic Farm, 8565 Horseshoe Lane, Potomac, MD 20854. Funding: $1,51. Maravell will use multiple bio-control methods to control corn earworm and European corn borer in successive plantings of organic, fresh market sweet corn and develop procedures for farmers concerning scouting, timing of intervention and evaluation of results. Maravell's project is aimed at reducing damage in later corn plantings and enhancing farm profitability for non-chemical farmers.

FNE93-13: "Subterranean Clover as an Organic Mulch for Pumpkin Production," Robert K. Clark, Chestnut Run Farm, RR#1 Box 804, Woodstown, NJ 08098. Funding: $1,576 Clark will test the use of subterranean clover as a mulch crop for co-cultivation with pumpkins. Clark's project, aimed a reducing erosion and synthetic fertilizer and herbicide

use, will examine the effect of clover on weed pressure, soil nitrogen, erosion and pumpkin yields.

FNE93-14: "Increasing Options for Cover Cropping in the Northeast," Steve Porter, Porter Farms, 5020 Edgerton Road, Elba, NY 14058. Funding: $1,865. Porter will evaluate the suitability of alternative cover crops for vegetable growers. The project, which includes demonstrations and replicated plots, will test non-leguminous cover crops that grow rapidly that take up leachable nutrients before winter-killing.

FNE93-15: "Evaluation of a Biocontrol Method for Farm Fly Management," Diane Matthews-Gehringer, Four Springs Farm, RD2 Box 243, Kutztown, PA 19530. Funding: $2,155. Matthews-Gehringer will compare the effectiveness of releasing parasitic wasps and insecticidal baits in reducing fly populations in hog and cattle housing.

FNE93-16: "Stewardship Forestry on the Farm," George W. Freeman, 831 Peterson Ave. Box 667, Knox, PA 16232. Funding: $3,890. Knox will demonstrate the effects of different timber harvesting strategies in Pennsylvania hardwoods. The project will focus on the long-term economic effects of harvesting on the total farm budget. This demonstration/study will be maintained for at least 10 years as a training site for farmers and loggers by the Penn State Cooperative Extension, the Pennsylvania Bureau of Forestry, and others.

FNE93-17: "Utilizing Municipal Leaf Compost in Apple and Peach Production," Steve Iuliucci,141 Route 73, South, RD 5, Braddock, NJ 08037. Funding: $2,403. Iuliucci will test the use of municipal leaf compost in apple and peach production. Iuliucci's goals are to reduce fertilizer and pesticide use, to improve soil health and fertility, to reduce tree disease, and improve the economic viability of the orchard.

FNE93-18: "Reducing Deer Damage to a Blueberry Plantation," William H. Sweet, 374 Jericho Street, White River Junction, VT 05001. Funding: $500. Sweet will test several methods of reducing deer damage to his highbush blueberry plantation, including human hair and red peppers, and mechanical deterrents such as noise and light.

FNE93-19: "Small Farm Biogas Production & Use," Ara Lynn, Liberty Farm, RR2 Box 1737, Poor Farm Rd, New Ipswich, NJ 03071 Funding: $5,096. Lynn will demonstrate the construction and cost-efficient operation of a biogas digester to improve waste management and recycling. He also plans to determine the savings achieved by using biogas instead of electricity to heat chicken brooders and piglet creeps. Finally, Lynn will analyze the nutrient value of the digester's effluent and determine its value as a replacement for other fertilizers.

FNE93-20: "Demonstrating a Sustainable Agricultural System by Using Beneficial Insects," James I. Munger, 908 Division Road, S. Dartmouth, MA 02748. Funding: $1,306. Munger will demonstrate the use of beneficial insects and predators to control insect pests in

greenhouse production of high-quality, European cucumbers. The project is aimed at demonstrating ways to reduce pesticide use in greenhouse production systems.

FNE93-21: "Evaluation of Puna Chicory Overseeding in Sheep Pasture in Central New York," Karl North, Northland Sheep Dairy, RD 1, Box 107B, Marathon, NY 13803. Funding: $1,975. North will test puna chicory overseeding in intensively grazed sheep pasture. North's project is aimed at developing low-cost, soil-building, and resource-conserving alternatives to confinement and feedlot systems of producing meat and milk.

FNE93-22: "Deep Root Organic Truck Farmers Co-op Mentor Program," Dennis Sauer, RR1 Box 606, Hardwick, VT 05843. Funding: $3,300. This project will catalog information needed to determine the impact of various farm prices on yields and make that information available to members and the larger farm community. One goal of this project is to increase the co-op's acreage base with skilled farmers, something needed to expand its markets and the overall security of the producer coop.

FNE93-23: "Mountain Sheep Project," David Major, RFD #3 Box 265, Putney, VT 05346. Funding: $3,600. Major will graze sheep on the slopes of a Vermont ski resort to maintain the slopes in an environmentally sound manner and strengthen the link between Vermont's tourist industry and agriculture.

FNE93-24: "Cranberry 2000," Darin Hammond, Webb District Road, P. O. Box 115, Harrington, ME 04643. Funding: $6,250. Hammond will test cranberry varieties for their suitability to eastern Maine climates. Hammond will also determine the different types and quantities of unwanted weeds growing in two growing environments and analyze the water requirements of the planted cranberries in the two environments. The project will establish cranberry plots in upland areas, rather than wetlands.

FNE93-25: "Demonstrate the Effectiveness of Fiber-Producing Goats as an Alternative to Chemical Weed and Brush Control Relative to Pasture Reclamation and Management," Ellen Reker, RD 3 Box 3378, New Tripoli, PA 18066. Funding: $5,000. Reker will demonstrate the use of cashmere goats to reclaim a 13-acre abandoned pasture. Reker's goal is to show that the goats can be used as a cost-effective alternative to chemical weed and brush control. She will also characterize the types of weeds and brush goats can control.

FNE93-26: "Integrated, Season Extension, Solar Greenhouse," Steve Gilman Ruckytucks Farm, 130 Ruckytucks Road, Stillwater, NY 12170. Funding: $5,825. Gilman will construct and test an innovative greenhouse designed to extend the growing season with using fans or added heat. The goal is to demonstrate an alternative greenhouse technology that does not require the large amounts of energy and expensive back-up systems typically used in greenhouse production.

FNE93-27: "A Wetland Demonstration Project for Water Quality Improvement, Wildlife Habitat Creation, and Farmer Education," Derek S. Dickson and B. C. Dickson, RD2 Box 268, Franklin, PA 16323. Funding: $5,000. The project leaders will build three constructed wetlands on their farm to improve water quality and wildlife habitat and educate other farmers. By taking selected areas of the farm out of production, the Dicksons are attempting to balance productivity with environmental goals.

FNE93-28: "Leaf Compost Potting Project - N. Casertano Greenhouses & Farms," Duncan McDougall, 1030 S. Meriden Rd., Cheshire, CT 06410. Funding: $2,895. McDougall will test various potting mixtures for container-grown perennials using leaf compost produced at Casertano Farms. The project is aimed at finding a cost-effective potting material, and possibly saving the town money by eliminating a town-run leaf recycling center.

FNE93-29: "Soil Heating in Unheated Tunnels," Michael Collins, RR 3 Box 1006, Putney, VT 05346. Funding: $973. Collins will develop a solar soil-heating system and compare tomatoes grown in heated soil with tomatoes grown in unheated soil. Collins project is aimed at designing a method for extending the early part of the growing season for tomatoes and increasing grower profitability.

FNE93-30: "Growing Fish on an Organic Farm," George McNulty, 36 Route 72, Manahawkin, NJ 08005. Funding: $2,600. McNulty will incorporate a fish production system onto his organic vegetable farm. He will compost fish waste materials for use in his cropping system, and use culture water for hydroponics. McNulty plans to market the fish with the organic vegetables at local restaurants.

FNE93-31: "New Sprayer Technology For Reduction of Pesticide Use in Apples," W. H. Palmer, Springbrook Fruit Farms, 5916 South Avenue, Williamson, NY 14489-9328. Funding: $4,060. Palmer will evaluate a new airblast sprayer that is designed to reduce the amount of pesticide applied to apple orchards by targeting the spray to only the actual tree canopy areas.

FNE93-32: "Managing Crowded Woodlots though Shiitake Mushroom Production," Pam Talley,.RT2 Box 230A, Caldwell, WV 24925, Funding: $3,000. Talley will produce shiitake mushrooms using management techniques aimed at improving the long-term productivity of the woodlot. Shiitake mushrooms are cultivated on hardwood logs. Talley plans to thin crowded stands, innoculate the cut logs with shitake spawn, clear the understory to increase air circulation to the desirable trees. Talley will also test a new packaging method for the mushrooms in an attempt to create a value-added product.

FNE93-33: "Evaluation of Integrated and Biological Pest & Disease Controls in Orchards," Dwight Mickey, 2197 Lincoln Way West, Chambersburg, PA 17201 Funding: $1,839. Mickey will evaluate the effectiveness of reduced chemical measures in a commercial peach and apple orchards. The project will use mating disruption and pheromone traps for insect control, and will compare conventional chemical fumigation with using canola oil

to control dagger nematodes. Diseases will be monitored and the participants will make predictions for pears and applies with a leaf wetness recorder..

FNE93-34: "Demonstration of Living Mulch Systems for Low-Input Tomato Production," Jim Quarella, Bellview Farms Inc., 429 Weymouth Rd., Buena, NJ 08310. Funding: $3,575. Quarella will demonstrate the use of a living mulch system for production of plum Tomatoes. Quarella will look compare the living mulch system, which uses hairy vetch, to bare ground and plastic mulch systems.

FNE93-35: "Evaluation of Alternatives to Synthetic Chemicals and Lime for Nutrient Supply, Weed Suppression, and pH Control on Raspberry Plants," John R. Shaw and Mark Towle, The Raspberry Farm, P.O. Box 700, 203 Kensington Road, Hampton Falls, NH 03844. Funding: $2,500. This project will test alternatives to chemical herbicides, fertilizers and process lime on raspberry plants. Shaw and Towle will use ash from wood-burning utility boilers, poultry manure, wood chips and composted biomass in the project.

FNE93-36: "Reactions of Peracetic Acid to Botrytis Cinerea," James Perkins Seven Springs Farm, 3056 E. Walker Rd., Bath, PA 18014-9349. Funding: $1,830. James Perkins, of Bath, who will receive $1,830 to experiment with the use of peracetic acid to control soft fruit rots in strawberries and raspberries. The project's goals are to determine whether peracetic acid (which breaks down to vinegar and water) could provide an environmentally benign alternative to currently available fungicides.

SUBJECT INDEX